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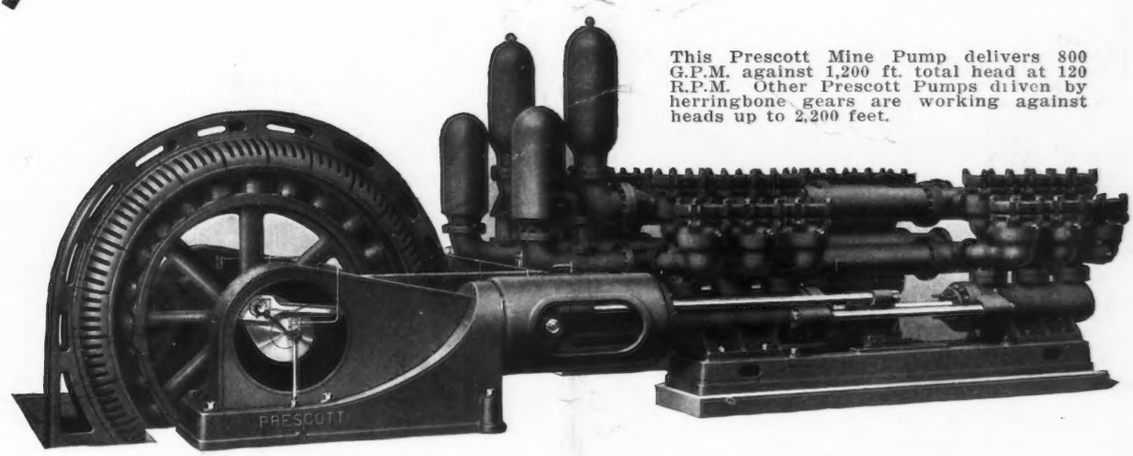

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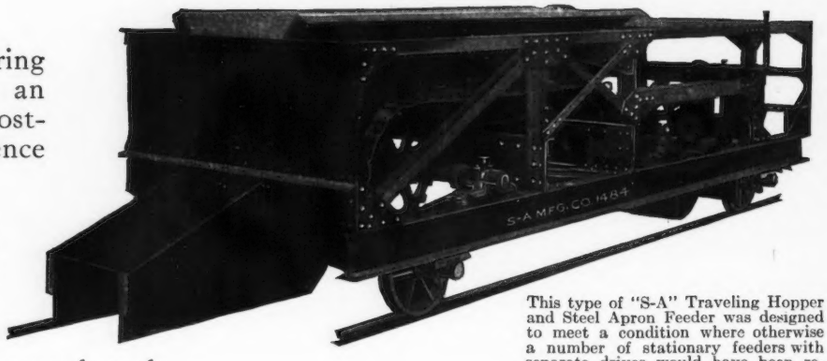

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Engineering and Mining Journal

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Barytes Mining in Georgia

By Arthur C. Vivian

SYNOPSIS—Deposits of barytes in the Cartersville district of Georgia were first exploited commercially in 1908, one small mine being worked. Since 1914, owing to stoppage of foreign supplies, the district has experienced a boom. Seven mines are now in operation and others being equipped. Mineral occurs as nodules in residual clays. Prospecting is conducted by small circular wells sunk by hand, and mining is by pick and shovel, or steam shovel, in opencuts. Ore-dressing process is simple, on account of the low market price of product.

Among the many mineral products requiring a readjustment of market conditions because of the present European struggle, is barytes. The supplies for consumption in this country have formerly been obtained almost exclusively from Europe. The reason that the American supply—probably ample for many years to come—has not been utilized to a greater extent is because in normal times a slightly higher grade of the material can be imported at a slightly lower cost than that of mining and manufacturing the domestic product. This is true partly because of the cheap labor in Europe, but particularly because of the low water-freight rates to our eastern ports, the principal market points for the material.

Extensive deposits of barytes have long been known to exist in the vicinity of Cartersville, Bartow County, Ga., but no attempt was made to work them until in 1908 Walter Satterfield secured a contract to supply the needs of a chemical firm and inaugurated mining on a comparatively small scale. This operation has continued uninterruptedly to the present time, but no other individuals ventured to enter the business locally until after the creation of the new demand in 1914. Then developments came rapidly, and at present there are seven operating mines in the district and several more are in process of equipment.

The significant geological feature of the district is the Cartersville fault, one of the major thrust faults of the Appalachian system. Striking northeast-southwest, it separates the Paleozoic sediments to the northwest from the older crystalline rocks to the southeast. The outstanding topographical feature is a range of rugged hills, which range roughly conforms in position to the neighborhood of the fault line. This ridge is prominent geographically, as it looms up before the observer from all points to the east or west; and it is also prominent economically, as it forms the locus of the mineral wealth of Bartow County. Deposits of iron, manganese, barytes and ocher are found along it for a distance of about 15 miles.

METHODS OF MINING BARYTES NEAR CARTERSVILLE, GA.

The deposits of barytes occur northwest of the fault in a deep mantle of residual clays derived from the decay of the quartzites, limestones and shales of the Paleozoic sediments. They are generally found along the crests or slopes of the ridges and are of irregular extent and outline, necessitating rather close prospecting. The barytes occurs as rounded masses of varying sizes, ranging from minute grains up to huge boulders, irregularly distributed through the clays. Except for clay included in cavities

within the mass and what might be termed potholes on its surface, the material is pure and assays of the cleaned product are said to show 98 to 99% of $BaSO_4$. The mode of occurrence in nodules suggests precipitation from solution as the origin of these ores, although they have been called residual by some geologists.

The method of prospecting for barytes and similar deposits in clay in this district is simple, cheap and reliable.

PROSPECTING FOR BARYTES NEAR CARTERSVILLE, GA.

A circular well, of uniform diameter throughout its depth, is sunk in the clays by hand digging with pick and shovel, the material being hoisted by a hand-operated windlass. The size of the well employed depends upon the skill of the man sinking it; and inexperienced men find difficulty in making wells less than 3 ft. in diameter, but more experienced well diggers can make them as small as 28 in. in diameter. It is of advantage to carry the well as small as possible because of the smaller amount of material to be removed and the higher speed in gaining depth. These wells can be carried as deep as desired, as later mining is by surface pit work and it is not generally desirable to prospect deeper than 40 or 50 ft.; though in certain instances wells have been sunk to depths of 100 ft. and more. In this method of prospecting, all the material from a uniform section of ground is removed and exposed to view, so that a better method could hardly be desired. The cost of this work varies between about 50c. and 35c. per ft. of depth, depending upon labor conditions, and the contract method is generally employed.

The accompanying photograph shows the top of one of these wells and the man who dug it. In this case the well is 28 in. in diameter and 31 ft. deep. It was in good barytes-bearing ground, as shown by the pile of that material in the foreground.

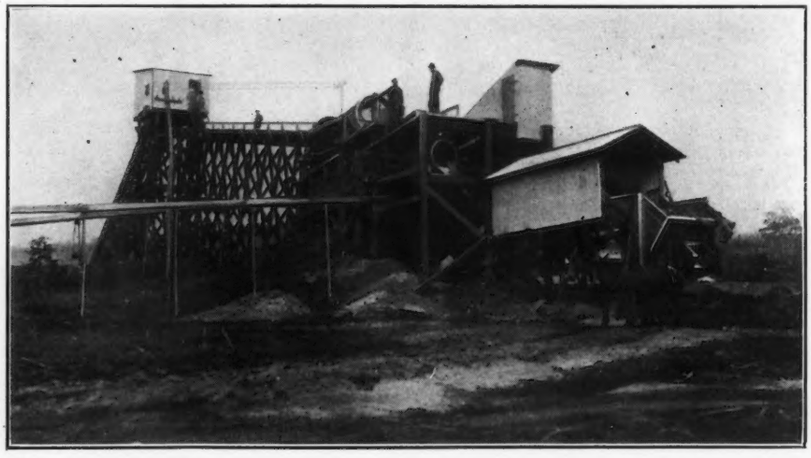
The mining is done in surface cuts either by hand-work with pick and shovel or by a small steam shovel. It is usual to begin operations by hand and to install the steam shovel later. The most-used type of shovel is the one in which the whole body rotates upon a center, as this is more convenient in the small pits than other types; but its weakness appears in the extraordinary strains on some of its parts as a consequence of its weight being pivoted at one point.

The material handled is soft and does not require much blasting, but the ground is loosened ahead of the workmen by springing and blasting churn-drill holes sunk by hand. Haulage is generally done by mules if the entrance to the pit is approximately level, or by small hoist engines in the case of inclines.

Dressing Ore by Log Washers and Jigs

The time-honored log washer is universally used to separate the mineral from its inclosing clay. This treatment is preceded and followed by hand picking, and usually the small washed material which passes a ¾-in. screen is jigged in ordinary plunger-type machines. The whole process is extremely simple. The material is dumped from the mine cars on a coarse grizzly, which serves the purposes of regulating the feed to the washer, giving an opportunity to remove by hand large pieces of waste and breaking up the material so that the water will do its work more rapidly. Water then conveys the material to a coarse trommel; the undersize from this goes to the washer, and the oversize is picked for the removal of waste and compact balls of gumbo clay, which would simply roll around in the washer and impair its efficiency. The washer is followed by another trommel, with ¾-in. openings, which removes the undersize material for jig treatment, while the oversize is hand-picked for the removal of iron ore and other foreign matter.

The jigs are usually of several compartments, but the feed to them is not sized; so that each compartment is expected to handle all sizes from ¾-in. down. The waste removed is principally quartz pebbles with some iron and manganese ore. Frequently no jigging is employed, in which case the opening on the last trommel is made about ⅜ in. and the undersize from this is flushed to a waste dump, the idea being to remove by this means all the small waste that cannot be hand-picked; the oversize material being further cleaned by hand.



INCLINE FROM SHOVEL PIT, HOIST, ORE-DRESSING PLANT AND SHIPPING BINS AT BARYTES MINE NEAR CARTERSVILLE, GA.

The natural criticism of the milling process is its crudeness, and no doubt much better results could be easily obtained by a little closer attention to details. Operators in this district, however, are used to handling low-priced minerals which occur in small and irregular deposits, so that efficiency in ore-dressing is always sacrificed to low plant costs.

Refining Barytes by Acid Treatment

The rather novel procedure of turning a flour mill and its equipment into a metallurgical plant is offered in the recent inauguration of barytes-refining in this locality. An old mill that had been idle for several years was utilized, and its steel rolls, stone grinders and bucket elevators were made use of without any alteration. It was only necessary to place coarse crushers, log washers and leaching tanks to complete the plant. The process is simply to crush the material and run it through a washer to remove the clay set free by crushing, recrush in rolls and the stone grinders and treat the resulting fine material with sulphuric acid in leaching tanks for the removal of iron and other impurities.

Oxidation of Nickel-Steel

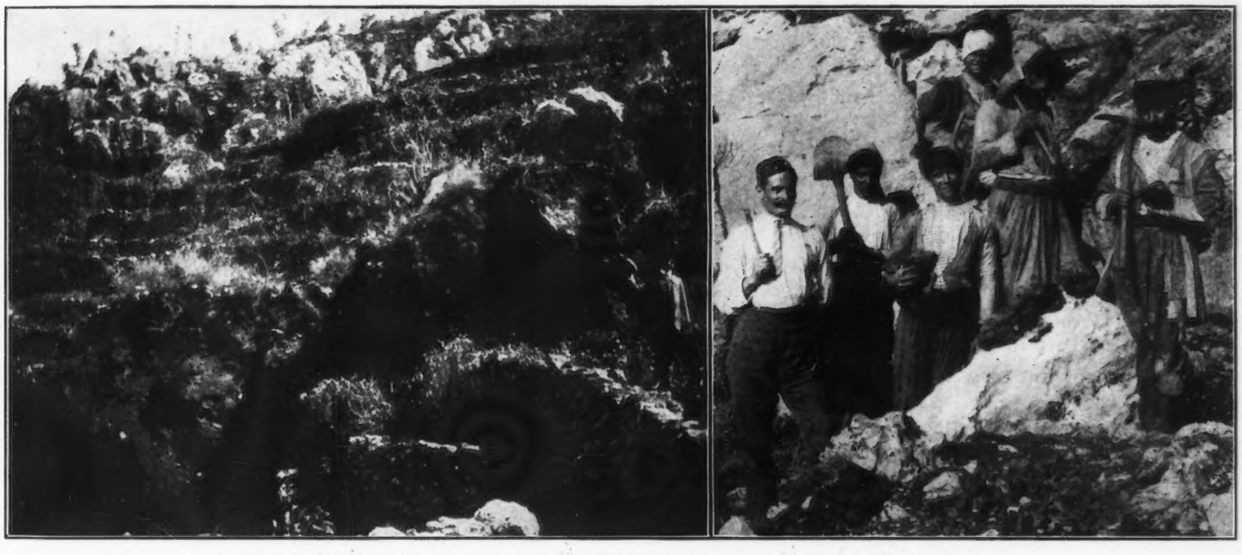
A note contributed by Dr. J. E. Stead at the recent meeting of the British Association discussed the peculiar properties of the scale which forms on nickel-steel. According to Dr. Stead, says *Iron Age,* Dec. 7, 1916, the scale is completely removed from ordinary iron or steel when it is rolled after heating. With nickel-steel, however, the scale remains hard on the surface, particularly if the metal has been heated for a long time, in which case the scale is very thick. With a short period of heating the scale is less adherent.

In searching for an explanation of these phenomena, Dr. Stead found, on making a section through the metal, that the scale and steel were locked together, points of the steel penetrating into the scale. An examination of a 25% nickel-steel ignition tube of a gas engine disclosed the metal on the outside to be completely oxidized, while an intermediate portion between the oxidized metal and the metal proper consisted of scale and unoxidized metal suspended through the scale. The unoxidized portions were wedge-shaped. The metallic part completely separated from the scale consisted of an alloy containing 75% nickel instead of 25%, the amount in the original composition of the metal.

Damascus Steel from Mount Lebanon Iron Ore

By J. F. Kellock Brown*

In the ancient history of the Near East, and in particular that of Palestine, the City of Damascus was at one time famous for possessing an iron and steel industry whose principal product was the manufacture of swords—swords that were known the world over for the strength and quality of their blades. Since fighting, rather than mining, was one of the chief pursuits of the world at that time, it is understandable that the remembrance of the quality of the swords remains in history, while all record of the source of the ore from which they were made has been lost completely. There are a number of theories and a number of places which lay claim to having been the areas from which this iron came, and among those are the deposits on the sides of Mount Lebanon, Palestine, which must have been operated many, many years ago.



MOUNT LEBANON LIMONITE DEPOSITS AND SYRIAN PROSPECTORS

These iron deposits exist upon the lower slopes of Mount Lebanon, about 20 mi. from the port of Beirut, Syria. They cannot be reached directly by rail, although there is a railway line that winds round this mountain. The easiest means of access is by muleback. Part of the geological formation of the district is sedimentary and is intermixed with large masses of white limestone. In some former geologic period these limestones were subjected to the passage of underground water which gouged out irregular cave-like holes of various dimensions. Simultaneously or subsequently these were filled up with limonite, so that as the Lebanon ore deposits now stand, they consist of large masses of ore embedded in the surround-

*Mining engineer, 247 Esplanade, Sydney, N. S.

ing limestone and without any connection to one another or any certainty in regard to size or continuity. Some of the holes visited would not contain 10 tons, while others would have held 200, although the only ore then visible amounted to a few remaining bunches left against the walls of the cave.

Here and there are a few untouched bunches of ore which might, if prospected, have developed perhaps a few additional hundreds of tons, but in general the possibility of ore in quantity is extremely disappointing when viewed from the standard of modern requirements. Still it is evident that the ore was worked in the distant past, and while present-day requirements could not possibly be met, it is quite reasonable to suppose that a fair-sized steel trade could have been supported many centuries ago. Tradition in the countryside has it that the deposits were once the scene of important activities, and so little has knowledge of modern developments in the steel industry, or any other industry for that matter, penetrated into the minds of the Syrians, that they are still in the attitude of hoping, and will continue to hope, that these deposits will sometime be operated. Plenty of men have been to see them, for the ores possess two interesting features that attract capital—the quality and the situation are good.

Transportation Facilities Were Favorable

As the scarcity of iron ore increases, 20 mi. from a fair seaport is nothing to feel discouraged about, especially as the grade for the entire distance is in favor of the load. Furthermore, the port of Beirut is at the end of the Mediterannean, not very much farther in regard to shipping distance than Greece or elsewhere in the East. Coal cargoes could have gone out to Egypt and ore could have been brought back, which would have formed a convenient round of shipment. The general situation promised cheap working, labor was plentiful and did not command high wages, and the actual mining and transportation conditions would have been as good as those existing at other deposits now being worked. About the only drawback was the attitude of the official classes and the uncertainty about the concessions granted to operate. Syria as part of Turkey is liable to much uncertainty as to what you have and what you hold. If the income to all the officials all along the line is not sufficient according to their eyes, your concessions are apt to be rescinded and presented to another party who has promised a little more side pay. There is a refreshing spontaneity about such proceedings that adds a zest to mining life, leaving aside the question that it also adds to the mining operations a sort of overhead cost not commonly reckoned with in more civilized countries. The best rule to follow is to bribe a big official and bribe high, trusting to the fact that the big man will keep the multiplicity of small officialdom in order for the sake of his own pocket. I suppose this official attitude is responsible for the native habit of never paying for anything that can be gotten by other means, which results in the natives becoming past masters of the art of begging .

The ore is a true limonite and is mechanically of good condition. This is due to the large percentage of lime present having become crystallized in the process of formation, resulting in a binding together of the ore into solid blocks. When broken, the faces thus exposed are almost capable of reflection from the crystallized lime. The quantity of silica is small, and the ore, when treated with acid, goes into solution with a rapid effervescence, leaving almost no residue. From the mode of their occurence the ores might be expected to be low in sulphur, phohsphorous, manganese and magnesia. An analysis of this character makes the ore attractive from the ironmaster's point of view, and for certain processes it is ideal. To appreciate its qualities, an analysis of ore is given with which comparison can be made: Iron, 58.47%; silica, 1.63%; phosphorous, 0.02%; moisture, 2%; alumina, 2.01%; lime, 8.73%; manganese, 0.73%; and sulphur, 0.01%.

From the ancient ironmasters' standpoint such ores would be much more valuable, since the appliances for and the knowledge of the methods of removing impurities was then small. This Lebanon ore contains but few impurities to be gotten rid of and moreover contains within itself a flux that would greatly aid in its reduction, both of these conditions enabling the old steel makers with their primitive means to produce a high grade of iron, which might easily have acquired a wondrous fame at such times.

Remembering that Damascus is not so far from the Lebanon hills, it is quite within the limits of imagination to assume that these ancient deposits could have been the original iron ores from which the metal afterward wrought into the famous blades was derived. They are certainly interesting as historical curiosities, although worthless as ore deposits from a present-day commercial standpoint.

Utilization of Etna Lava

According to S. Pagliani, in *Annali Chim. Appl.*, 1916, VI, 157-62, through *Journ. Soc. Chem. Ind.*, Mount Etna lava has been used for some years with good results in an Italian works, for the construction of apparatus for the concentration of sulphuric acid, Glover and Gay Lussac towers, condensing towers for hydrochloric acid, and other plants in which Volvic lava or analogous material is usually employed. Not all specimens of the lava are suitable for such purposes, but large quantities of material of satisfactory quality are available in the quarries.

Analyses of samples of the lava deposited at different epochs (from 122 B.C. to 1910) show that the maximum, minimum and average values for the percentages of the various constituents are as follows: SiO_2, 51.89, 46.25, 49.13; Al_2O_3, 22.67, 15.91, 19.84; Fe_2O_3, 19.32, 9.13, 11.47; $CaO + MgO$, 17.18, 11.60, 13.38; $Na_2O + K_2O$, 8.41, 2.12, 5.81%. The porosity of a sample of the lava, as measured by the weight of water absorbed per 100 parts of material, was found to be 0.48, as compared with 0.74 for granite.

Precious and Semiprecious Stones and Graphite are the only mineral products of any importance in Ceylon according to a recent statement in "Commerce Reports" of the Department of Commerce. The market for stones was poor, owing largely to the cessation of tourist trade. Prices were generally kept up, nevertheless, production being curtailed. Graphite, recovered quickly from the slump of 1914. The exports rose from 284,562 cwt. of 112 lb. in 1914 to 436,351 cwt. in 1915. During the first half of the year the graphite industry was quiet, but with the removal of the embargo on exports to America prices rose quickly and reached $438 per ton for ordinary lumps. The United States, the United Kingdom, and Russia took most of the increased exports.

Efficiency of Compressed-Air Installations--II

By Theodore Simons*

SYNOPSIS—The avoidable losses in the transmission and use of compressed air are considered the most common being due to leaks in the pipe lines.

Fifteenth Loss—Probably the greatest of the avoidable losses in compressed-air installations and the one most frequently met with is that due to leaks in the pipe lines. That leaks do not receive more attention on the part of operators appears to be chiefly because of their failure to realize the startling magnitude of losses due even to seemingly insignificant leaks if permitted to do their wasteful work for any length of time, and to the further fact that not sufficient surveillance is exercised in the use of compressed air for underground drilling and ventilating purposes, the valves in underground branch pipes being frequently left wide open without serving any useful purpose.

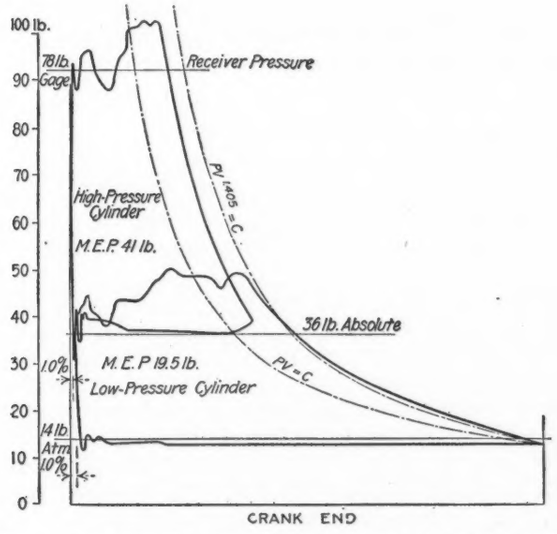


FIG. 1. COMBINED INDICATOR DIAGRAM OF 2-STAGE COMPRESSOR

Knowing the approximate area of a leak or the combined area of a number of leaks and the normal pressure of the air within the pipe, the volume V_a of escaping air, expressed in cu.ft. of free air per minute may be obtained very closely from the following equation:

$$V_a = 72A\sqrt{\frac{p(p+p_a)}{p_a}}\ cu.ft.\ per\ min. \qquad (27)$$

in which p = gage pressure of air within the pipe in pounds per square inch, p_a = atmospheric pressure in pounds per square inch and A = area of leaks in square inches.

Example: Air under a pressure of 80 lb. gage escapes from various leaks in a pipe line, having a combined area of ½ sq.in. What is the quantity of escaping air and loss expressed in hp., with atm. pres. = 14.7 lb?

$$V_a = 72 \times 0.5\sqrt{\frac{80(80+14.7)}{14.7}}$$

$$= 820\ cu.ft.\ of\ free\ air\ per\ min. \qquad (28)$$

To compress in one stage 820 cu.ft. of free air per minute to 80 lb. gage and deliver it into the receiver requires (from equation 1)

$$W_n = 4{,}320{,}000\ ft.\text{-}lb. = 131\ hp.\ (theoretical) \qquad (29)$$

Adding 15%, as before, we get

$$Actual\ hp. = 151 \qquad (30)$$

The enormous loss shown to be due to seemingly insignificant leaks gives an inkling as to what will happen when leaks of far greater extent are permitted to do their nefarious work without being given the least attention.

Sixteenth Loss—Extremely wasteful in consumption of power are branch pipes that are too small for the volume of air they are supposed to transmit without extra loss of pressure. The frequency with which branch pipes are improperly dimensioned indicates that this feature of a plant is given but scant attention.

To the uninitiated the statement that it takes practically two 5-in. pipes to carry the same volume of compressed air, during the same time and without extra loss of pressure, that one 6-in. pipe can carry seems rather extravagant. To the engineer who is conversant with the subject, an attempt to transmit the capacity of one 6-in. pipe, for instance, in two 3-in. pipes seems still more extravagant from the point of view of loss entailed. Yet such are the conditions one often meets with even in plants installed under otherwise efficient supervision. They are among the principal causes of the constant cry for more air and for higher pressures on the part of the drill-runner and hence for more compressors, to the gratification of the manufacturers. No one seems to think of making the branch pipes larger.

The problem of calculating branch-pipe diameters is identical with that of the main pipe, and the dimensions are or should be determined by the same rules. But it seems that though the main pipe may have been properly calculated by the engineer, the branch-pipe problem is usually left to the practical pipe-fitter, with the results stated.

Example: From a 6-in. main at a point 1,200 ft. from the intake terminal, a branch pipe is to be taken off to furnish 75-lb. air to operate three 3¼-in. piston drills 600 ft. from the point of take-off. What should be the dimensions of the branch pipe?

To solve the problem intelligently, it is necessary to know as accurately as possible the air pressure in the main pipe at the point of take-off. A pressure gage is the proper apparatus to use for this purpose. If this is not practicable or if the branch pipe is to be planned simultaneously with the main pipe, the expected pressure at the point of take-off must be calculated from the given data. For our problem we will assume that this pressure is 80 lb. gage.

Three 3¼-inch piston drills using 75-lb. air require 360 cu.ft. of free air per minute.

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Applying the Rix-Johnson formula, the minimum diameter of the branch pipe should be

$$D = \sqrt[5]{\frac{V^2 L}{2{,}000(P_1^2 - P_2^2)}} \qquad (31)$$

in which $V = 360$, $L = 600$, $P_1 = 80 + 14.7$, $P_2 = 75 + 14.7$; whence $D = 2\frac{1}{2}$ in.

A pipe smaller than that would supply neither the required quantity nor the required pressure, yet quite likely one would find a 1-in. pipe used for the purpose.

The intelligent planning of a net of branch pipes is a problem far more difficult and intricate than that of the main pipe. It should be intrusted to the most competent expert in that line of work and not be left to the discretion of the pipe-fitter.

Seventeenth Loss—Poor alignment both in the horizontal and vertical position of the pipe line, requiring frequent bends, causes losses far greater than is commonly realized. Five elbows, for instance, with a radius of 18 in., in a 6-in. pipe line create an extra frictional resistance equal to that of an additional 20 ft. of the straight pipe. This points to the advantage of avoiding bends even at an extra expense of laying the pipe.

Inasmuch as engines using compressed air as motive power are, in principle, the reverse of a compressor, the avoidable losses in the use of compressed air are analogous to those encountered in its production. Neglect of care on the part of the attendent is the usual cause of such losses, provided, of course, that the engine is adapted to the work it is to perform.

Increasing the Mechanical Efficiency of Installations

The most important means at our command for increasing the mechanical efficiency of air compression, and therefore of a complete system, is so-called stage compression.

The initial cost of a two- or multi-stage compressor is considerably more than that of a single-stage machine and therefore only warranted when the operations are of a more or less permanent character. But when once installed and operated with the required care, the saving of energy will soon pay for the extra cost of the machine.

The theoretical work of two-stage compression and delivery is

$$W_n = 2\frac{144 n P_a V_a}{n-1}\left[\left(\frac{P_2}{P_a}\right)^{\frac{n-1}{2n}} - 1\right] ft.\text{-}lb. \qquad (32)$$

in which P_a and P_2 are initial and final absolute pressures and V_a, volume of free air in cubic feet to be compressed.

To compress to 80 lb. gage, the pound of 80° F. air at sea level ($V_a = 13.593$ cu.ft.) would require

$$W_n = 61{,}400\ ft.\text{-}lb.\ (theoretical) \qquad (33)$$

and

$$W_n = 70{,}600\ ft.\text{-}lb.\ (actual) \qquad (34)$$

This represents a 14% saving in compression power alone (see equation 4).

The volume V_2 into which the pound of air is compressed by two-stage compression, assuming perfect intercooling, is

$$V_2 = V_a\left(\frac{P_a}{P_2}\right)^{\frac{n+1}{2n}} = 13.593\left(\frac{14.7}{94.7}\right)^{0.855} = 2.76\ cu.ft. \qquad (35)$$

The theoretical temperature of the compressed air will be

$$T_2 = T_a\left(\frac{P_2}{P_a}\right)^{\frac{n-1}{2n}} = 541\left(\frac{94.7}{14.7}\right)^{0.144} = 710°\ absolute$$
$$= 249°\ F. \qquad (36)$$

If we allow it to cool down to initial outside temperature (62° F.), its pressure will fall to

$$P'_2 = P_2\frac{T'_2}{T_2} = 94.7\frac{523}{710} = 70\ lb.\ absolute \qquad (37)$$

We may then assume a volume of 2.76 cu.ft. of air at an absolute pressure of 70 lb. entering the pipe line. With the same size of pipe as before, the friction loss will be somewhat less, say 4 lb. The loss is accompanied by an increase in volume.

$$V_3 = V_2\frac{P'_2}{P_3} = 2.76\frac{70}{66} = 2.93\ cu.ft. \qquad (38)$$

Thus we have to operate the air engine a volume of 2.93 cu.ft. of air at an absolute pressure of 66 lb.

Using it expansively, down to 16.5 lb. abs., and applying equation 10, we can perform work

$$W_n = 33{,}900\ ft.\text{-}lb.\ (theoretical)$$

and

$$W'_n = 28{,}800\ ft.\text{-}lb.\ (actual) \qquad (39)$$

Hence, efficiency of whole system:

$$E = \frac{28{,}800}{70{,}600} = 41\% \qquad (40)$$

This increase in mechanical efficiency of the whole installation has been accomplished not by a greater, but by a lesser expenditure of energy. Two-stage compression would therefore appear to offer a vast advantage over single-stage compression.

Granting perfect conditions, it does. But it is here where the engineer will have occasion to observe great discrepancies in existing plants. He will frequently find that instead of saving power, the two-stage compressor consumes more power than the single-stage compressor, owing either to faulty construction or to neglect on the part of the operator. Such conditions are illustrated in the combined indicator diagram, Fig. 1, taken from a two-stage compressor in actual operation.

Two-stage compressors giving cards such as shown fail to realize a saving of power over single-stage compressors usually through one or the other of the following defects:

1. Cylinders not properly proportioned for prevailing compression ratio. In the case illustrated the high-pressure cylinder seems to be too small, throwing too much of the compression work upon the low-pressure cylinder.

2. Intercooler too small or inefficient. The theoretical saving of power is based on perfect cooling of the air between cylinders. Failure on the part of the intercooler to do this will increase work in the high-pressure cylinder.

3. Valve areas too small and air passages restricted. Restricted inlet-valve area in low-pressure cylinder increases the work to be done and reduces the compressor efficiency. Restrictions in high-pressure inlet and low-pressure discharge valves and in the intercooler produce an excessive discharge pressure from low-pressure cylinder to intercooler and a depression in the suction line of high-pressure indicator cards. The result is a great overlap in the developed diagram where the high- and low-pressure cards come together. Pressure losses also pro-

duce an unequal distribution of the work in the two cylinders.

In the case illustrated the terminal pressure in the low-pressure cylinder should have been 36 lb. abs. The diagram shows that the discharge valves of the low-pressure cylinder did not open until the pressure had reached nearly 50 lb. abs., indicating a large waste of energy.

Under (2) it is stated that the theoretical saving of power is based on perfect intercooling. This means that cooling water must be provided sufficient to abstract all the heat generated by compression in the low-pressure cylinder. When an unlimited supply of water is available, this is quite possible. But more often water is scarce and expensive and must therefore be used over and over again. Usually it is pumped to a so-called cooling tower and returned to the compressor by gravity. This, evidently, entails an extra expense that must be taken into account when planning the installation.

Before deciding on the kind and size of the compressor, one must be sure that the necessary quantity of water for either method is available, else the most perfect machine will fail to show the saving of energy that is expected. It is here that the engineer again has occasion to meet with many imperfections. Though the intercooler and the pipe leading to it may be of ample dimensions, the required amount of water is often lacking, resulting in conditions such as shown in the indicator card.

Quantity of Cooling Water Required

It may be asked, What is the required quantity of water? The answer is self-evident when it is remembered that 1 B.t.u. will raise the temperature of 1 lb. of water 1° F. Hence the number of pounds W of water necessary to abstract a certain number of B.t.u.'s from a substance is equal to this number of B.t.u.'s, assuming that the water's temperature is not to be raised more than 1° F.

$$W = w(t_1 - t)s \text{ lb.} \qquad (41)$$

in which w = pounds of air to be cooled, t_1 = its temperature in degrees F. after compression, t = its initial temperature and s = specific heat of air at constant pressure = 0.2375.

When water is scarce, one has to be contented with a saving of energy somewhat less than the theoretical. It is then customary to allow an increase in the temperature of the cooling water amounting to from 10° to 25°. In actual practice some of the compression heat is dissipated by radiation, so that the amount of water required becomes still less. For rough estimates the minimum number of gallons G of cooling water required per minute in a 2-stage compressor may be found from the following formula:

$$G = 0.0001\ C(t_1 - t) \qquad (42)$$

in which C = free air in cubic feet per minute being compressed, and t and t_1 = theoretical temperatures in degrees F. before and after compression. Theoretical temperatures of compressed air for two-stage compression are found in the bulletins of compressor builders, or they may be computed from equation 36.

The transmission efficiency of a pipe line evidently is the ratio of the energy residing in the air at the discharge end of the pipe to the energy residing in the air at the intake end, assuming the temperatures to be practically the same at both terminals. For the same size pipe, the efficiency can be materially increased by increasing the intake pressure. In this connection it is well to remember that the required power to compress is not directly proportional to the end pressure. To compress 100 cu.ft. of free air per minute in two stages to 60 lb. gage requires 12.10 hp. To compress it to 180 lb., which is three times as much, requires only 20.8 hp., which is less than twice the former horsepower. This feature may be taken advantage of in planning the transmission as well as the use of compressed air.

Efficiency Increased by Reheating

The most effective means of increasing the potential energy of a quantity of compressed air is the reheating of the air before use in the air engines. While not applied as frequently as it might be, the saving that can be effected by this method is being realized more and more by operators.

At the compressor plant of the Anaconda Copper Mining Co. at Butte which supplies air to the company's hoisting engines, an ingenious system was devised by the builders of the plant, the Nordberg Manufacturing Co., which contributes materially to the efficiency of the whole installation, although involving a considerable increase in the original and maintenance cost of the plant. It consists essentially of a number of receivers or expansion-tanks which are placed 210 ft. below the compressor plant and are connected to a large water reservoir near the compressor building and a little above the latter's floor level. Thus a uniform hydrostatic head equivalent to 90 lb. pressure is maintained on these receivers, the entire capacity of which can be used at full normal pressure, the air being displaced by the water as it is required. When the combined demand of all hoisting engines exceeds the supply from the compressor plant, the excess air is drawn from the expansion tanks and water runs down from the reservoir into these tanks to take the place of the air. When, on the other hand, the supply exceeds the demand, the surplus air is forced into the tanks, and in turn forces the water back into the reservoir on the hill.

Since the energy residing in a quantity of compressed air depends on its pressure as well as on its volume, it stands to reason that by increasing either one or both we can increase this energy. The process known as reheating consists in forcing the compressed air upon arrival at the point of use through suitable vessels that present large areas of highly heated surfaces to the air which, while passing over them in thin sheets, becomes itself heated and therefore expands into a larger volume, practically under constant pressure.

In practice air is reheated to temperatures as high as 300° F. The volume, and therefore the energy of a certain quantity (weight) of air, is thereby increased to from 30 to 50% over that it possessed before entering the reheater. Higher temperatures are not advisable, as the lubricant in the air engine is then apt to char, causing severe cutting action on the valves, rods and stuffing-boxes.

To accomplish the results stated, there must, of course, be an expenditure of fuel or other heat-generating energy (electricity). However, if coal is the fuel, as it is in most of the large reheating plants now in operation, only about one-eighth (theoretical) is used of the amount that would be originally required to compress air so that it could develop power equal to that developed by the

reheated air. To illustrate: To produce an extra cubic foot of 75-lb. air by a steam-driven compressor would require 474 B.t.u.'s. while by reheating, 2 cu.ft. of 75-lb. air can be made out of one by an expenditure of only 58 B.t.u.'s. This does not take into account the efficiency of the reheater.

The possibilities of reheating, particularly for underground work, where its introduction meets with various difficulties, offer a vast and profitable field to the inventor—a field that has by no means been explored as much as it deserves.

Efficiency Increased by Operating Details

The plant as a whole should, in the first instance, be placed in charge of a competent man and a staff especially trained for the work. Pressure gages should be inserted at frequent intervals in the pipe line, or provisions made to insert them for taking readings, especially at the junctions of branch pipes. These readings should be systematically recorded so that abnormal discrepancies may be followed up to their source and remedied as soon as discovered. The use of air should receive strict supervision, and, if possible, the quantities used should be frequently measured by means of reliable air meters. Willful waste of air should make the offender liable to discharge.

Such, in general, is the procedure adopted by the larger operators in the Butte and other camps who have found out that it pays to provide facilities for observing and recording the performance of all machinery and appliances constituting their compressed-air systems.

There are numberless other means that will suggest themselves to the intelligent and conscientious supervisor for improving this branch of the service and for avoiding losses that without such supervision are bound to occur with steadily increasing magnitude.

Acid-Resisting Iron Apparatus

According to N. Swindin in *Chem. Trade Journ.*, 1916, LIX, 323-4, through *Journ. Soc. Chem. Ind.*, the general design of plant in which acid-resisting iron alloys are used is similar to that where steel is employed, except that due allowance is made for the greater liability of the alloys to fracture from the action of internal stresses. Unequal cooling being the chief source of trouble in this respect, the thickness of the castings should be as uniform as possible and the presence of relatively large masses of metal (for example, at the junction of two or more walls of the apparatus) avoided. Although parts with flanges and ground or machined faces are obtainable and sometimes indispensable, plain spigot and socket joints should be used wherever possible; pipe apparatus of the kind under discussion is seldom subjected to high pressures, and excellent cements to withstand every kind of acid liquid or gas are now available for making such joints quite tight.

As in the case of other metals used for pans, etc., the most reliable form of casting for acid-resisting iron alloys is a hollow sphere or portion thereof; flat surfaces should be avoided wherever possible and, if unavoidable, should not be larger than 18 in. square. The very shallow pans used for concentration purposes are ribbed and corrugated, thus providing an increased surface for heat transmission and overcoming foundry troubles by breaking up flat surfaces. The advantages of the iron alloys over earthenware, etc., are most apparent in nitric-acid plants, chiefly as regards the great reduction in size and increase in efficiency of the condensing apparatus. For denitrating sulphuric acid, towers made of iron alloys are very successful, but being slightly attacked by weak (although not by strong) sulphuric acid, cascade basins and pans of these alloys can be employed only in the lower part of the run if iron-free acid is required.

New Steel Mill in Chile

There has recently been developed in Santiago a steel industry on a small scale, using as raw material the old iron formerly exported to Europe, says *Commerce Reports*, of the United States Department of Commerce, Washington, D. C. The high price of steel after the outbreak of the European War led to the domestic manufacture of this article through the efforts of an engineer, Matec Vucetich, and a capitalist, Bernardo Granello. Great difficulty was experienced at first in finding skilled workmen, until Spaniards were secured from Bilbao, where the steel industry is developed. Chileans were taken on as apprentices, and the force now employed numbers about 100, not including those who collect the old iron. A special foundry had to be built for making the needed machinery, which was turned out after European models, as was also the refining furnace. Chilean coal is being used, which is another item of economy.

The products of the mill include bars, plates, angles, tees, construction steel for concrete buildings, carriage parts, bolts, nuts, nails, horseshoes, tires, etc. The Chilean steel sells for 20% less than the imported steel. A fair quality has been obtained, and the operating difficulties encountered at first are now being overcome. The demand for steel in Chile is large and increasing, which assures an immediate market for all that can be produced at the Santiago mill.

Siam's Imports of Mineral Oil

With imports amounting to 8,349,257 gal., the United States Department of Commerce reports that Siam's purchases of foreign mineral oil in the year ended Mar. 31, 1916, were only slightly larger than in the preceding fiscal twelve-month, as the following table discloses:

Articles and Countries Whence Imported	1914–15 Gallons	1915–16 Gallons
Kerosene	6,167,674	5,792,615
United States	1,897,960	1,494,360
Netherlands Indies	4,269,714	4,298,255
Gasoline	334,804	294,430
United States	23,944	31,968
Netherlands Indies	310,860	262,462
Liquid fuel	1,166,910	1,882,588
Netherlands Indies	907,892	1,685,972
Singapore	259,018	196,616
Lubricating-oil	396,948	379,624
United States	151,481	156,681
India	22,365	.....
Netherlands Indies	91,926	116,369
Singapore	53,498	94,345
United Kingdom	76,038	11,990
Grand total	8,066,336	8,349,257

British Imports of Manganese Ore in October were 38,360 gross tons against 42,389 tons in September and 60,931 tons in October, 1915. The total for the 10 months to Nov. 1, 1916, was 386,754 tons against 270,745 tons to Nov. 1, 1915. The receipts for the 10 months this year are at the rate of 42,973 tons per month against 30,083 tons per month for the same period in 1915. Imports of manganese ore into the United States to Oct. 1, 1916, were 469,222 tons—exceeding the British receipts.

Chart for Determining Heat Loss in Flue Gases

An interesting and valuable diagram has been prepared by H. F. Hutzel and published in *Power*, Dec. 12, 1916. As shown it affords a simple means for determining the heat loss in flue gases. This chart is based upon the following formulas:

$$W = \frac{4 \times CO_2 + O_2 + 700}{3(CO_2 + CO)} \times \frac{C}{100} \qquad (1)$$

in which W represents the pounds of flue gases per pound of coal burned and C represents the percentage of carbon in coal. CO_2, O_2 and CO represent, respectively, the percentages by volume of carbon dioxide, oxygen and carbon monoxide found in the flue gases.

$$H = W \times 0.24(T - t) \qquad (2)$$

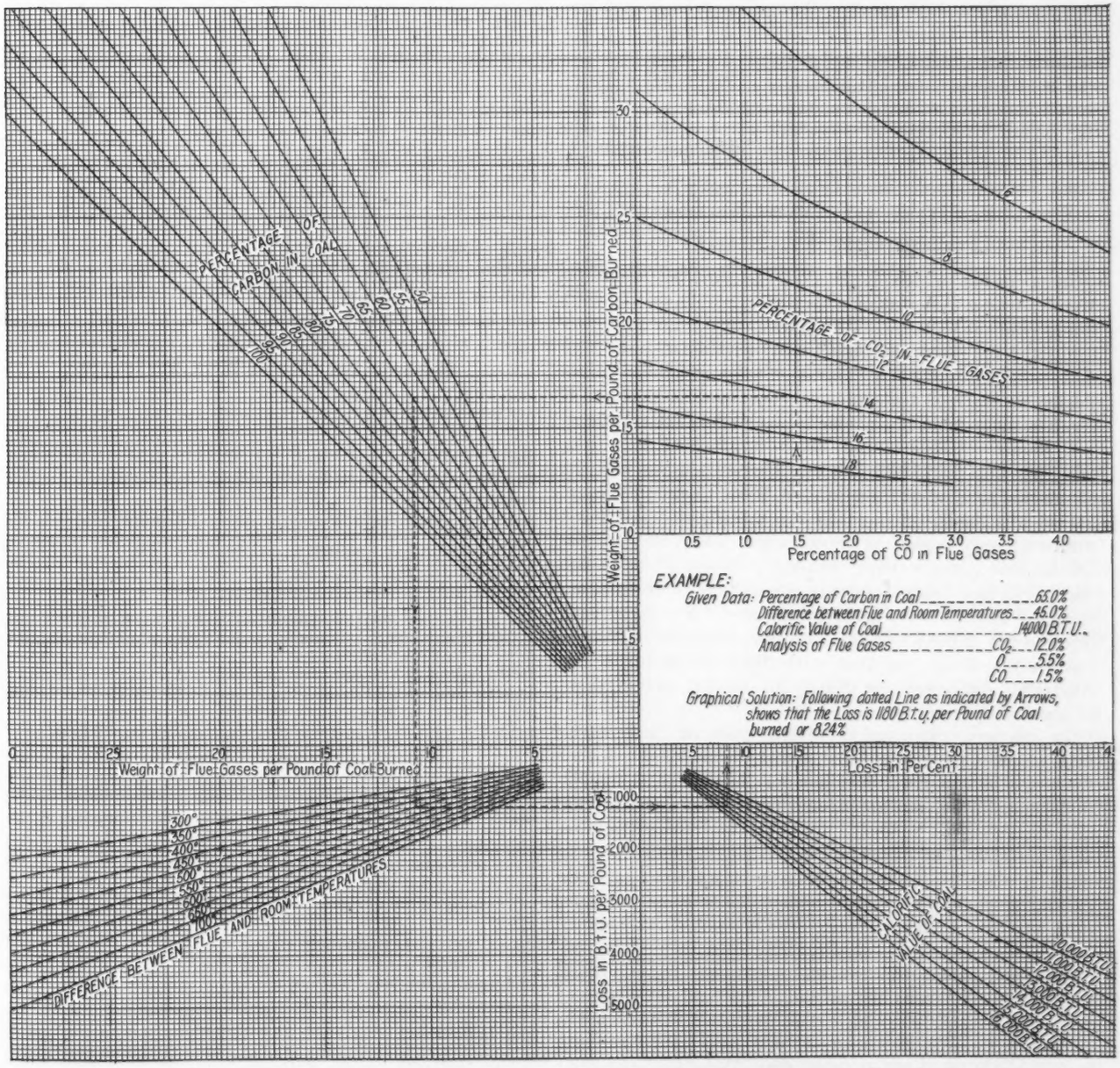
in which H represents the heat lost in B.t.u. per pound of coal burned and (T — t) represents the difference in temperatures between the flue gases and room.

$$P = \frac{H}{K} \qquad (3)$$

in which P represents the loss in per cent. and K represents the calorific value per pound of fuel as fired.

Since the percentage of oxygen is an indication of the amount of excess air that is being supplied to the furnace, it would naturally be supposed that the abscissas of this chart should represent O instead of CO. The reason for having abscissas represent CO rather than O is as follows:

In the formula given for determining the weight of flue gases, it will be observed that there are three variables; namely CO_2, O and CO, which vary as the state of combustion varies. With these variables almost an infinite number of combinations might be formed,


PERCENTAGE OF CARBON IN COAL
Weight of Flue Gases per Pound of Carbon Burned
PERCENTAGE OF CO2 IN FLUE GASES
Percentage of CO in Flue Gases
EXAMPLE:
Given Data: Percentage of Carbon in Coal 65.0%
Difference between Flue and Room Temperatures 445.0%
Calorific Value of Coal 14000 B.T.U.
Analysis of Flue Gases CO2 12.0%
O 5.5%
CO 1.5%
Graphical Solution: Following dotted Line as indicated by Arrows, shows that the Loss is 1180 B.T.U. per Pound of Coal burned or 8.24%
Weight of Flue Gases per Pound of Coal Burned
Loss in Per Cent
Loss in B.T.U. per Pound of Coal
DIFFERENCE BETWEEN FLUE AND ROOM TEMPERATURES
CALORIFIC VALUE OF COAL AS FIRED

COMBUSTION OF COAL IN BOILER FURNACES CHART FOR DETERMINING HEAT LOSS FROM

therefore making it almost impossible to produce a chart for determining flue-gas losses that would cover all cases.

In order that the accompanying chart might be made to cover any example, I have made an assumption that is neither theoretically nor practically correct, yet the error introduced is so small as not to affect the accuracy of the readings on the chart more than a fraction of one per cent. The assumption made is that the sum of the percentages of CO_2, O and CO, as indicated by the flue-gas analysis, is 21% for all samples. This sum might be somewhat less, owing to hydrocarbons in the fuel, but even then should not total less than 19%. In case of the presence of CO, the sum might be more than 21%, but seldom does it exceed this amount. That the assumption made might introduce as small an error as possible, the percentage of oxygen as shown in equation (1) was determined by subtracting the sum of the percentages of CO_2 and CO from 21. From the formula it will be observed that the numerator for any analysis will be much greater than the denominator. Therefore, even though the percentage of oxygen as determined by the foregoing method is incorrect by a small percentage, the value of *W* will hardly differ from the true value. On the other hand, should the value of CO have been determined as that of the oxygen, any slight error might effect an appreciable error in *W*, since the CO appears in the denominator.

Protection of the American Tungsten Industry

In a leaflet which it is distributing, the Colorado Metal Mining Association sets forth the facts which it thinks indicate the necessity for a protective duty on tungsten ore and manufactured products. It says that prior to 1914 the United States produced practically one-half of the tungsten consumed in this country, the imports coming chiefly from Australia, Portugal, South America and later from Burma. The price per unit varied from $2 in 1900, when the first lot of ore was sold, to $11 per unit in 1907, when the largest output was made. Since tungsten mining in the United States actively began, in 1900, output and price for the ore in this country have invariably decreased with the opening of new fields in foreign countries, and at the same time the imports were largely increased. For some time prior to the outbreak of the European War the output of the Burma fields, together with that of Portugal and Australia, depressed the American market and a price of about $6 per unit prevailed.

In January, 1915, the prevailing price in the Boulder field was $5.60 per unit for a 60% product; in December the price had reached $50, and in March, 1916, in one instance at least, upward of $100 per unit was paid for ore containing 60% WO_3. In 1915 the total production of this country, as given by the United States Geological Survey, was 2,165 tons of 60% product—only a little greater than the 1910 output, when the average price per unit was $8 and the production 1,821 tons.

According to a report by Frank L. Hess, of the Geological Survey, during the first six months of 1916 Colorado marketed 1,505 tons of tungsten ore and concentrates valued at $3,638,000; California, 984 tons, valued at $3,005,000; Nevada, 461 tons, valued at $1,432,000; and Arizona, 175 tons worth $565,000. Smaller quantities were mined in Alaska, Connecticut, Idaho, Missouri, New Mexico, South Dakota, Utah and Washington. It is obvious from the foregoing that with remunerative prices for the ore the mines of this country are capable of a production equal to any demand that might be made upon them, and if worked to full capacity, mining activity would be largely increased in Colorado, California, Nevada and Arizona and doubtless new and important discoveries would follow in other states.

The price paid for tungsten-bearing ores in the United States is, generally speaking, determined by the offerings of foreign ore. This ore is mined under cheap labor conditions and at a price far below that for which it can be produced at a profit here. A comparison of conditions under which tungsten is mined here and in foreign countries is of interest at this time. In Burma most of the ore comes from alluvial deposits worked on contract by natives who earn about 48c. per day. Considering the fact that ocean transportation from foreign fields to New York is in most instances less than by rail from the tungsten mines of the country to the same point, it is obvious, in an industry where labor is so large a factor in the cost of production, that the tungsten miner of the United States cannot compete with the coolie labor in Burma, the bushman in Australia, the underpaid miner of Portugal or the Indian of Peru or Bolivia.

Another phase of this subject to which the tungsten miners of the United States would direct attention is the relation of this industry to the campaign of preparedness now under way in this country. Consistent reasonable protection for the industry, with due regard for all of the interests involved is the only policy that can adequately meet the requirements of the future and establish tungsten mining as a permanent industry.

Bauxite Brick Linings

Bauxite brick for furnace linings is discussed by W. C. Phalen in a United States Geological report on "Bauxite and Aluminum in 1915," concerning which *Iron Age*, Dec. 7, 1916, says: "The purer the material used the more refractory the brick. The addition of bauxite to refractory clays not only increases their alumina content, but also their refractoriness. The two kinds of brick in common use, made by hydrous oxide of aluminum, contain 56 and 77% of alumina respectively. The lower-percentage brick are used as fireclay brick, but will withstand higher heat. Those containing the higher percentage have been used as a substitute for magnesite brick for open-hearth and other furnaces. Mr. Phalen cites an instance where bauxite brick were used in the port end of a furnace, forming a bulkhead for that particular furnace for 365 heats, after which a new roof was put on. The opposite port of magnesite brick is reported to have been in a worse condition."

Victoria Mineral Output, 1915

The mineral output of Victoria, Australia, during 1915, according to the Secretary of Mines, was valued at £1,737,158, a decrease of £349,025 from the preceding year. The gold produced (329,068 oz.) was valued at £1,397,793. Other items, in descending order of value were: Coal 588,104 long tons; antimony ore, 11,113; tin ore, 95.5; silver, 11,687 oz.; diatomaceous earth, 274 long tons; wolfram, 14.5; gypsum, 690; brown coal, 2,864; magnesite, 189; kaolin, 402; and manganese ore, 97.

West Coast Travel Observations

By A. P. Rogers*

SYNOPSIS—Travel on the West Coast away from the tourist routes involves many hardships, unsanitary conditions and culinary disappointments. The great mass of the natives are ruled by a small aristocracy actuated mainly by ideals of bygone centuries. All these West Coast countries are jealous of, and fear one another. Better acquaintance with the United States is being cultivated, however, and each feels that closer relations with that country may help protect it from its neighbors.

South America is our latest hobby; the papers are full of the immense opportunities and markets for trade lying open to us there; financial and Government commissions are making trips there, one after the other, while tourists in shoals have been flocking over the same routes this past year; and finally, mining engineers and representatives of capital are as thick as bees everywhere. But what sort of a place is this "West Coast Country," as it is called; and especially, what are the people like. Ask most of these visitors the latter question, and you will not get a really satisfactory answer—except possibly from those who have stayed there awhile. Why? Because they skip and fly around over the same old trails at topmost speed and, lacking the comforts of home, they are indisposed to remain long enough in one place to really get to know the people or study the country. But it is too big a subject to comprehend in any other way.

United States Travelers Bias Opinion

Up to very recent times South America has been a kind of hazy myth to the average person—not unlike the mountains of the moon or the canals of Mars—and mention of the West Coast Country is more than likely to bring only a blank stare. We are so self-centered here at home, each with his own local interests, that we have not had time to focus on anything else, and only now are we learning that there are real neighbors to the south of us who have their everyday life just as we have ours. Only comparatively few of them, however, know as much about us as we do about them; and they judge us, as they must, through the visitors we send them—good, bad and indifferent. This is not only deplorable, but it is not right and it is high time we became better acquainted.

The West Coast comprises five different countries, but the term here is more strictly applicable to only three of them—Chile, Peru and Bolivia; and the last-named has today no coast line at all. It is always included in the term, however, as there was a time, some 40 years ago, when Bolivia did own a most important, if uninviting-looking, bit of seacoast—before Chile conquered it—where have since been developed fabulously rich deposits of copper, nitrate, borax and other minerals. Think how we should feel if we had lost a country containing one copper deposit alone rich enough to pay our national debts, and you will have the same qualms the Bolivians have who put through that transaction. You will also understand why these countries are now crying out against any more sales of national resources, except at absurdly extravagant figures, to the little understood "Yankee." The inhabitants are impressionistic people, extremely sensitive, and secretly afraid of where they will land in the end with all these deals; hence it is desirable for us to allay their fears as much as we can. We must live up to the doctrine of "live and let live," but they in turn must learn to work and get over the idea that it is a disgrace to soil their hands with labor.

While the South Americans regard us in this rather awesome way, they realize the advantages to accrue to them from investments in their countries and are constantly emphasizing the fact of a lack of local capital (and brains) for the developments needed everywhere. They are also slowly learning that an honest, stable government, with fair and just laws, is the primary requisite for a torrent of new settlers and all the capital they can use. It takes time, however, to educate sparsely settled countries, where the customs are centuries old, to a new condition of affairs, and we must not expect them to accomplish everything in a day. It should be sufficiently encouraging now for us to know that we are liked and that a better acquaintance would be welcomed throughout that whole vast continent.

Lack of Good Harbors Handicaps Travel

The West Coast Country—referring to Peru, Chile and Bolivia—as the average tourist sees it in sailing southward, is a barren waste of desert mountains rising from the sea from 1,000 to 3,000 ft. in height, giving occasional glimpses of the great snow-capped peaks of the Cordilleras behind, when the clouds permit a view. The so-called ports, where the boats stop nearly every day, are nothing but open roadsteads, a few of them having piers to which the steamships cannot approach, and are such desolate-looking places there is no temptation to go ashore. Callao and Valparaiso are the only exceptions to this rule, as they are better situated, and with close connections to the capitals of their countries are naturally the important places no visitor ever misses. South of Valparaiso the appearance of the coast changes to one more like that of British Columbia, but only comparatively few tourists take this southern trip.

At nearly every one of the smaller ports from Peru southward, there are short lines of railroad extending back into the interior valleys, most of which terminate at the foot of the towering Cordilleras—a mighty natural wall. From Callao, Mollendo, Arica and Antofagasta, however, the lines have been extended over the mountains to the great central plateau between the western and eastern ranges of the Andes, and then branch out into longitudinal lines both north and south. This central-plateau country is a most extraordinary region—from 10,000 to 13,000 ft. high and over 1,000 mi. long in Peru and Bolivia—having a climate entirely at variance to that usually encountered in the tropics. There is a rainy season and a dry season, it is true, but in other respects the climate is more temperate than tropical on account of the altitude, especially toward the south. Before the Spaniards came, this plateau was the home of the ancient Inca Indian civilization, comprising some 30,000,000 souls.

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In Peru the soil is extremely rich and generally well watered, but in Bolivia water is always scarce and much of the country is a desert. A great variety of crops are raised by the Indians for sale in the markets, although potatoes and corn are their own staple diet. Sheep, goats, mules and cattle are also raised everywhere, and this is the real home of the famous llama, a curious, stupid beast, but the most useful animal the Indians possess.

The ancient Inca towns on the plateau are slowly being renovated for the reception of tourists, and the trip from one to the other can now be made comfortably in trains provided the traveler can stand the altitude. It is a bit trying at first, but one soon becomes accustomed to it, and a little asperin is a very efficacious remedy for the mountain sickness, called "seroche."

Covering some 150 mi. of the plateau between Peru and Bolivia is the famous Titicaca Lake, the highest body of navigable water in the world, from which the Desaguadero River flows in a very winding course to the south over 200 mi. and empties into Lake Poopo. This lake is only about 14 meters lower in elevation than Titicaca and has no outlet. The whole region was evidently once a great inland sea, and the present lakes are all that remain of it. Bounding the plateau country on the east is the main range of the Andes Mountains, rising into towering snow-capped peaks, while beyond them the country rapidly drops away and changes into the tropical jungle region of the Amazon basin, fever-ridden and unhealthy. A huge slice of southern Bolivia lies just outside this category and on the Rio Plata watershed, but it is such a wilderness that it plays no part in the life of today.

Northern Chile contains the great Atacama desert, where it hardly ever rains; and south of that lies the beautiful central Chile valley, reminding one of California, with the overpowering Andes behind; while still farther south the country is full of wonderful lakes and heavily wooded mountains and has a wet climate, similar to the British Columbia coast. Almost every variety of country known to man lies in this 3,000 mi. of West Coast region. Of it all, however, probably the most beautiful part is that in central Chile, from Santiago south to the lake country. And, to my mind, the richest in mineral resources in all South America is the forbidding desert region of northern Chile and southwestern Bolivia. As it is also a trying and dangerous region to travel in, where false steps are fatal to the trifler, it pays to be wary of it.

Wornout Ideals Actuate Ruling Classes

With this sketchy outline of the West Coast Country, upon which no end of descriptive books have been written, I prefer to leave it and get at the people, as it has been well said that "men are what make a state, without regard to their environment." To understand them better, however, it is necessary to repeat a little history. These people are all descended from the original Spanish adventurers and conquerors, mixed in greater or less proportion with the subjugated Inca and other Indian inhabitants. The proportion of Indian blood shows plainly in the characteristics of the people in the different countries, and I believe that explains the leading position held by Chile, where there was less mingling of the races. The Inca Indian of Peru, especially, was nothing but a slave, little better than an animal. From what I have read, the Spanish conquerors were probably a curious mixture of marvelously energetic adventurers and bloodthirsty, cruel villains, who balked at nothing to attain their end. The combination of the two races, as seen today, is better than what might be expected.

Each country had its own struggle for independence, followed by internal jealousies and revolutions, and then came the inevitable boundary disputes over the nitrate deposits when they were discovered, culminating in 1879 in the short but bitter war between Chile on one side and Peru and Bolivia on the other. By absolutely routing her neighbors, Chile took from Bolivia her seacoast around Antofagasta in consideration for an insignificant payment and from Peru the valuable provinces of Tarapaca and Tacna, with the inevitable result of an endless feud. Since then each country has had numerous revolutions of greater or lesser importance until the present day. You may say that revolutions are wrong and out of date in this enlightened age, but what can one expect when one considers the ancestors of these people. Time alone will cure the situation, helped by the proper immigration all the West Coast is calling for, and by universal education—especially the latter. There are far too many illiterate peons to make a real republic anywhere, and unless a change is brought about, there always will be the fear of another such condition as exists in Mexico just now. In Bolivia, for example, with a total population of less than some of our larger cities, over 90% of the inhabitants are illiterate Indians, many of them savages.

Labor Conditions Approximate Slavery

The great plateau region is divided into large "haciendas" owned by the ruling class, a small element, who pass the laws. Each of these haciendas has a certain number of Indians who live on the land and do the agricultural work—to all intents and purposes nothing more than slaves. They are always reckoned as an asset and are quoted as such in any transfer of ownership, in other words, they go with the land and are obliged to supply so much produce every year to the owner. They are a densely ignorant, servile race and lead a dreary life with no pleasures in it, unless an occasional drunken orgy or a weird tune played by a lonely sheep herder on a reed flute can be classed as such. Naturally, the more educated owner of the land spends mightly little time among these "children," and he takes good care to see that all land taxes are kept at their lowest possible figure. He prefers to see the government taxes raised in some other way—by monopolies on salt, matches or tobacco, or by taxing the exports from the mines, many of which are owned by foreigners. Any suggestion that he should be more heavily taxed and forced to divide his land holdings among the actual tillers of the soil, or that the Indian peon should be educated, by compulsion if necessary, meets with an astounded refusal. And yet the need for such a course is most pressing in Bolivia today to start an improvement in the country. The members of the luckily born, small upper-crust class, should recognize that their position is one of trust, to be conceded and maintained only on condition that they will also work or lose their rights. It is the same trouble as that in Mexico and in all the other Latin-American republics, where manual labor or drudgery of any kind is considered impossible for the gentleman, provided someone will support him or he can get something for nothing by gambling or some other gentlemanly accomplishment.

In Chile the original tribes were never subjugated by the Spaniards, but the wealth of the country is vested in the owners of large haciendas just the same, worked in a dreadfully inefficient manner by the peon class, called "rotos" locally. These peons have some Spanish blood in them and are more intelligent than the Bolivian Indians, having some slight education, but the same principle obtains among the upper classes. To my mind the "roto" is the hope of Chile, as he is a worker, aggressive, and is slowly becoming more temperate. The army should probably be thanked for that. Obligatory military service is universal in all these countries—under German instructors until the war began—but Peru and Bolivia are too poor to support the full classes every year, and a few months' training is all that many a man gets.

Currency and Exchange in Deplorable Shape

Notwithstanding that the Chileans are more progressive and wealthy than their northern neighbors, their currency and exchange is in a deplorable condition. No gold is in circulation, and the paper money is worth only one-sixth as much as ours. Exchange fluctuates at a lively rate and affords a substantial living to those who know the game. While there is sufficient gold on deposit to give a value of 11 pence to the peso today, the exchange hovers around 8½ pence, for which the large landowners may be blamed. Owning the country and paying their workmen in pesos while they receive gold for their products, naturally they do everything to keep the rate of exchange down. With so many English houses established there, imports have been maintained in spite of the war. In Bolivia, on the other hand, where the Germans have hitherto controlled the importing business, the imports stopped long ago, and with heavy exports of tin, copper and other metals, the landowners could not control the exchange at all. In Peru the same condition prevails and exchange is very high, although in neither country is any gold in circulation at the present time.

Greatest Wealth of Peru Agricultural

Peru, while containing many profitable gold, silver, copper, coal and oil deposits, has its greatest wealth in agricultural resources. Great sugar and cotton estates are owned by the leading families, and in the higher country, products suitable for those temperatures are raised, but all under similar conditions to those found in Bolivia and Chile. Transportation is even more difficult in many places here than in Bolivia, as the country is cut up by immense cañons and high mountains, so that long intercommunicating lines of railroad are difficult and expensive to construct. It is related that a traveler who was riding over the mountains in northern Peru, where one goes up one range and down another with no apparent end, became weary and remarked: "It is said that the Lord made heaven and earth in six days, but this must have been a late Saturday night's job"; and he was not far wrong.

To the traveler from the North, perhaps the most striking things impressed on his memory are the filth and outrageous food he finds everywhere. Except in Lima, Valparaiso or Santiago, the hotel accommodations are inexcusable and even in these places they are only passable. It is a constant fight to obtain fairly clean, sanitary arrangements, and in such places as Cuzco it seems almost a hopeless task. The doctrine that "cleanliness is next to Godliness" is dreadfully hard to spread, but I am optimistic enough to hope that they will learn in time. The prevailing idea of a delicious dish is to throw a lot of grease, garlic, vegetables and meat of any kind into a dirty pot of water and heat it over a smoky fire. It is perhaps unjust to represent this as an unvarying custom among all classes, but it is the memory of such which the average traveler, through Peru and Bolivia especially, will bear away with him. The tantalizing part of it is that everything necessary is produced in abundance, and only a little knowledge of the culinary art is required to live as well as anywhere.

I have told many Chileans that all they need are proper roads and good hotels to draw a host of tourists to their lovely country, but they merely smile and say they lack the money to build them. From Panama south the traveler is always surprised to find how cool and smooth it is, and with faster ships and fewer stops the time could be reduced tremendously.

Amusing Personal Traits and Customs

The Spanish-American loves to sit around and talk with his friends. It makes no difference whether he has anything to talk about or not, he will talk just the same. It affords a chance for a glass of beer, or some other beverage. He is always seeking tranquility for his thoughts, especially on any business deal, and it is useless, or worse than that, to try to hurry him.

His pleasures or recreations as we know them, are most noticeable by their absence. It is surprising to see what simple amusements interests the crowds in every city. The English game of football is quite popular, and billiards is played by all natives, but beyond that they do not go, preferring a stroll round and round the plaza, to see and to be seen, while the band plays in the evening.

In Chile there is enough wealth to support a summer colony at Viña del Mar on the coast near Valparaiso, where the favorite amusement is to go to the "Playa," or beach, late every afternoon and stroll about. Pretty faces and the latest frocks are daily on exhibition, and it is an attractive sight, but I am afraid we Americans want more action in a steady routine. Then, on Sundays, there is always horse-racing at beautifully laid-out courses in Viña and Santiago. This sport is very popular and much better than the ugly bullfights held in Lima.

Latin-American people are most hospitable and courteous to every visitor in their homes, but as many of them speak very little English, it is desirable for us to do our part. The average American, when he finds himself not understood, acts as if his listener were deaf and tries yelling for a change, much to the latter's amusement. Spanish should be taught in all our schools if we are to help the cause.

I have tried to mention a few of the characteristics of these West Coast people, who are kindly disposed and would like to know us better, with a hope that our acquaintance may progress. The troublous times in Europe emphasize the necessity of it, if nothing else does, and the immense wealth in natural resources awaiting someone's brains and capital should stir Americans to an effort while they have the chance. It is unfortunate that Argentina, Uruguay, Paraguay, Chile, Bolivia and Peru are not all one country, as they are all from the same parent stock and should be combined into one government. These countries are something like a large family, each jealous—if not afraid—of the encroachments of his

neighbor, so that our position, provided we send them proper representatives who speak the language, will be a very advantageous one. We are so far away they do not really fear any colonial desires by us, and they feel we can protect them from one another.

Zinc Mining at Broken Hill*

The average number of men employed in the mines in the Broken Hill field during 1915 is estimated at 5,315, compared with 7,855 during the previous year. Many of the mines attempted only maintenance work underground and repairs to or installations of new machinery on the surface.

The Broken Hill Junction Co. mined 1,100 tons of crude sulphide ore averaging 15% lead, 10% zinc and 12 oz. silver per ton.

The British Broken Hill Proprietary mined only carbonates in the upper mine levels—1,883 tons of ore containing 595 tons of lead and 11,298 oz. silver. Broken Hill Proprietary, Block 14, produced principally from development 8,916 tons of carbonate containing 2,396 tons of lead, 124,664 oz. silver, in addition to which 986 tons of sulphide ore was stacked on the dump. Broken Hill Proprietary, operated on a reduced scale owing to the war. The mills handled 189,046 tons of crude ore, producing 33,036 tons of lead concentrates, while the handling of old dumps and tailings by the regrinding plant produced from 164,541 tons of ore, a total of 4,491 tons of lead concentrates.

Broken Hill South Silver Mining Co., operated under war-restricted conditions and with a total shutdown of 55 days. The mill treated 294,530 tons of ore assaying 14.7% lead, 7.5 oz. silver and 14% zinc, from which was produced 55,619 tons of concentrates assaying 60.6% lead, 23% silver, and 9.8% zinc. The tailings delivered for treatment to the Amalgamated Zinc plant totaled 181,924 tons assaying 3.1% lead, 3.4 oz. silver, and 17.2% zinc. The recovery was 77.6% lead and 58% silver. On the 1,270-ft. level the orebody was developed for a width of 105 ft., averaging for this whole distance 14.3% lead, 8.6 oz. silver and 14.8% zinc. Ore reserves now total 3,350,000 tons.

Zinc Corporation, Ltd., installed new machinery, improved ventilation, and did considerable development work, including three diamond-drill holes. Sulphide Corporation, in spite of war conditions, maintained the normal ore production, the total output being 242,043 tons. Amalgamated Zinc operated intermittently. North Broken Hill produced 258,213 tons of ore from the mine and treated 261,939 tons assaying 15.9% lead, 7.45 oz. silver and 12.95% zinc, producing 52,800 tons of concentrates assaying 61.2% lead, 20.9 oz. silver and 8.9% zinc. The recovery of the metals was thus 77.6% lead, 56.6% silver and 13.7% zinc.

During the year the Broken Hill Associated Smelters, Ltd., purchased the Broken Hill Proprietary Co.'s smelting and refining works at Port Pirie. The new company was formed by four of the leading mining companies of Broken Hill: Broken Hill Proprietary Co., North Broken Hill, Ltd., Broken Hill South Silver Mining Co., and the Zinc Corporation, Ltd. One of the objects of the new company is to extend the smelting industry in Australia and to enable the mines of the associated companies to be independent of foreign smelters, who, up to the present, have controlled a large portion of the trade. At present the output from these mines is regulated by the capacity of the smelteries, which is considerably below the average production of the mines. Steps are, however, being taken to enlarge the plant to cope with the requirements of these mines. The benefit to this field by the purchase should be far-reaching.

*Abstract from Mineral Report of the Department of Mines, New South Wales, for the year 1915.

World's Shaft-Sinking Record

By A. Cooper Key*

A new world's record in shaft sinking—252 ft. in 31 days—has been created by the Crown Mines in its new No. 14 shaft, situated in the southern portion of the property in what is known as the Bovysers Reserve on the South African Rand. In the 30 days of September and on the first day of October, this shaft was sunk 246 ft. and 6 ft. respectively, totaling 252 ft.

The shaft is circular, similar to that sunk some time ago at the New Modderfontein, of 21 ft. 6 in. diameter before and 20 ft. after bricking.

The sinking was done with the aid of 30 natives, working 90 shifts. Five Ingersoll-Rand machines were used per shift. To break the 9,120 tons of rock excavated, 67 cases of gelatin were consumed. This rock was hoisted in a 3-ton bucket, the hoisting being done by one steam engine connected with two boilers.

The previous sinking record was made by the Modder Deep Levels in April, 1912, when 234 ft. was sunk in one of the twin shafts. This shaft had three compartments, two measuring 5x6 ft. and one 6x6 ft. The Modder Deep beat the record created a month earlier in the southeast shaft of the Modder Government Gold Mining Areas by the narrow margin of a foot. This, in turn, was an advance from the 213 ft. of the Modder Deep constituting the previous record. Previously the best record was that of the Brakpan Mines, made as far back as July, 1907.

It may be pointed out that the Government Areas shafts are longer than that being sunk at the Crown Mines, measuring 45x10 ft. before timbering. This portion of the shaft was sunk through 155 ft. of quartzite and 78 ft. of shale. About one-third of the distance was sunk in the formation known as the Kimberley shale, in which almost all of the previous records had been made. The Crown Mines record was accomplished while sinking entirely in quartzite.

The 1912 records, now surpassed, were made at a depth of about 2,000 to 2,500 ft., whereas the total depth of the Crown Mines new shaft is not far from 1,000 ft. It is being sunk to strike the main reef at a depth of about 4,500 ft. If it goes to this full distance, and the dip of dikes has yet to be revealed, it will be the deepest shaft in the Rand, surpassing the Jupiter and Village Deep shafts, which are 3,900 ft., and City Deep (eastern), which is 3,800 ft. deep.

During the first six months of sinking not a single accident occurred, Ivor Rees, the mine overseer, being a keen observer of safety-first rules.

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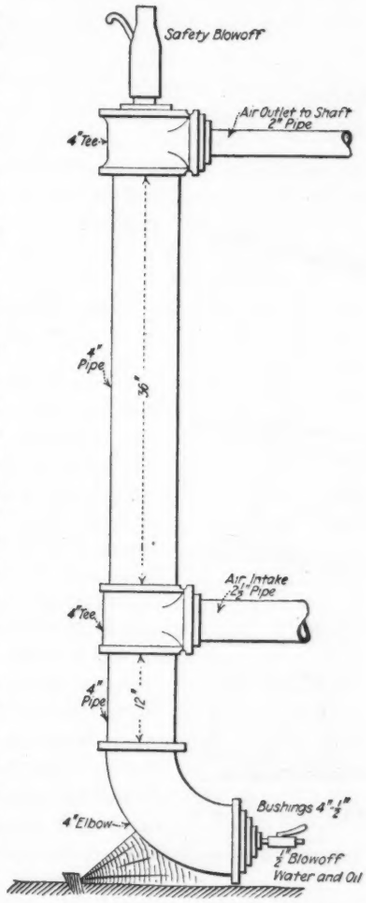
Details of Practical Mining

Oil and Water Separator for Compressed-Air Line

By J. F. Kellock Brown*

In any remote prospecting operation an oil and water separator such as that illustrated will be found to be a useful and handy piece of apparatus. The use and care of compressors on such work is not scientific, the men available for the work are ignorant, and so it frequently happens that oil troubles develop in the machine underground. When you add to that the freezing due to moisture in the air, the value of any kind of apparatus that will help to mitigate these drawbacks is apparent. A separator should of course go along with every compressor, but we all know what prospecting outfits are—there is always something that should be there but never is sent, and a separator on the air line is one of the things frequently conspicuous by its absence. Usually there is nothing available from which to make one. This at least was the case on the work where the separator described was used. Its construction will readily be understood from the illustration, pipe and fittings being all that is required. The air intake from the compressor was a 2-in. line and the outlet 2½ in. The separator itself consisted of 4-in. pipe with the necessary tees and elbows to suit. Above the air exit the 4-in. tee was bushed down to hold a 2-in. safety valve, while the foot of the separator, which ended in an elbow, was also bushed down to hold a ½-in. turn-cock taken from an air drill. By watching and keeping the lower space clear of the collected moisture and oil that came over from the compressor, a great improvement in the quality of the air was obtained.

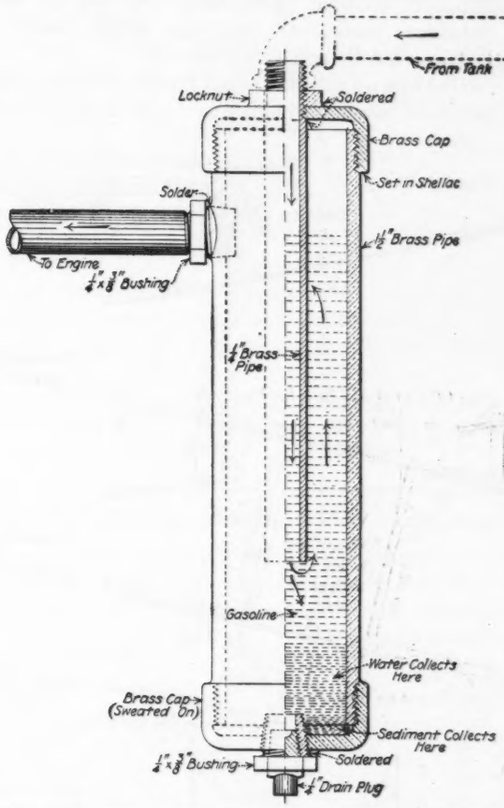


DETAILS OF WATER SEPARATOR

*Mining engineer, 247 Esplanade, Sydney, N. S.

Separator for Gasoline Line

A water separator shown in the accompanying sketch and described by H. H. Parker in *Power* for Dec. 19, 1916, has been used for about seven years in the fuel line of a marine-type heavy-duty oil engine to remove the water, etc., that sometimes gets into the tanks as well as sediment contained in the fuel oil, which is not strained. No water, dirt or sediment from tank scale ever gets to the carburetor, even when the mixture is "riled up" in a seaway. The separator should prove satisfactory on any gasoline or kerosene engine.



SEDIMENT-SETTLING CHAMBER IN OIL-SUPPLY LINE

The construction is fairly simple. In this case the body is made of 1½-in. brass pipe and two brass caps, the lower one being sweated on while the upper is set in shellac so that it may be removed. The upper cap is drilled and tapped for ¼-in. brass pipe, having a running thread on the upper end. It is threaded up through the cap and has a locknut on the outside, to increase the bearing surface of the threads, and the whole is sweated together. This forms a connection for the fuel pipe from the tank. This ¼-in. pipe should extend to within about 2 in. of the bottom of the large pipe. The lower cap is drilled and tapped for a ⅜-in. bushing which is securely soldered in and a ¼-in. drain plug or a key-cock is screwed into it. On the side of the large pipe near the

top another bushing is screwed in and soldered, thus making a connection for the fuel pipe to the carburetor.

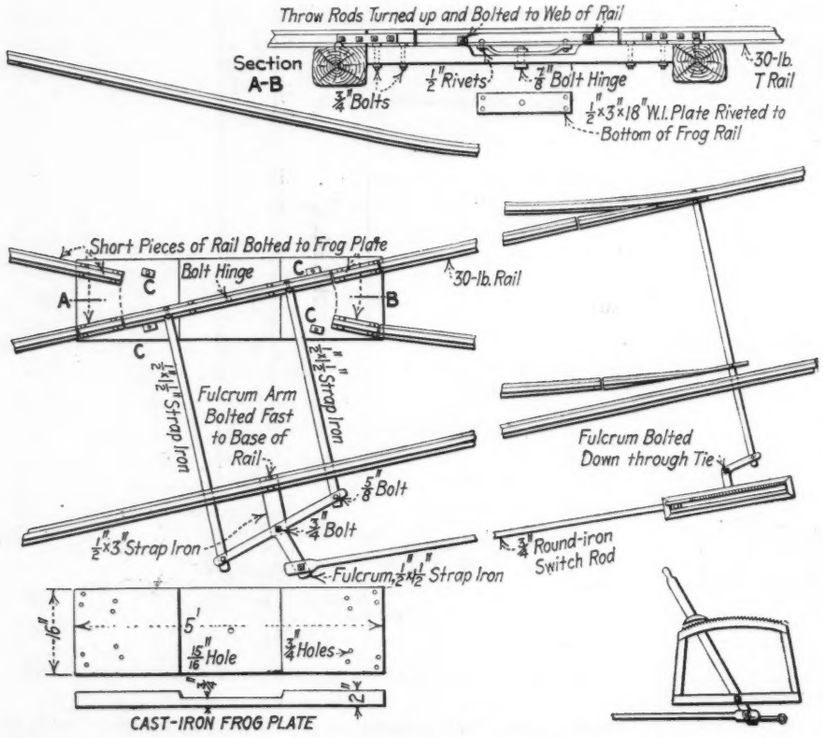
In operation the water and sediment settle to the bottom, while the clean fuel rises to the outlet pipe. The separator, of course, may be made any size; the larger it is the more dirt and water can be allowed to collect before draining.

A Frogless Switch

A frogless switch was described by Le Baron Smith in *Coal Age,* Nov. 18, 1916, and a brief description is presented herewith.

The switch is adapted particularly for use on main electric haulage roads, at partings which must be frequently traversed by mine locomotives.

It is a well-known fact that much trouble is experienced at these points in the maintenance and upkeep of switches, using ordinary frogs, owing to the locomotive wheels becoming grooved at certain times to a depth, which while not justifying a change of wheels, often causes a broken frog or a derailment, entailing delay and expense.



PARTING SWITCH WELL ADAPTED FOR USE OF ELECTRIC HAULAGE ROADS

In the accompanying drawing it will be seen that the frog is replaced by a pivotal rail, arranged at the juncture of the convergent rails of the main and branch tracks. This pivoted rail is connected by two bridle bars and a throw rod to the same switch lever which operates the latches. When the switch lever is thrown to one side, setting the latches for the branch track, the pivotal rail forms a part of the branch track, and when the switch is reversed for the main track, it becomes a part of the main track. The drawing shows it in the latter position.

The pivotal, or swinging, rail section is fastened to an iron baseplate, having a depression in the center which allows room for the pivot hinge. Four short pieces of rail are bolted to the plate, one at each corner, their angle of convergence forming what would ordinarily be termed the angle of the frog. Each of these rail sections is drilled for fishplates, to connect with the abutting rails. The baseplate is also well spiked to the ties, making the whole solid and rigid. Small plates *C* are bolted to the base, to limit the throw of the swinging rail and insure its proper alignment with the connecting rails.

This switch is located at the main parting near the bottom of the shaft, at the juncture of the loaded and empty tracks. It is always set for the loaded trips coming out, the brakemen on the empty trips opening and closing it as they go in. It has been in continuous operation for two years, with a daily average of 60 to 70 motor trips (about 1,300 cars) passing over it, has not cost one cent for repairs and has given perfect satisfaction. The motormen are much in favor of it, there being no jar or jumping of the locomotive in passing over it when the wheels are worn, as is the case in running over the ordinary frog.

The switch, which is patented by W. R. Ross, trackman at the Morrisdale No. 1 shaft, has many points of merit, but unfortunately has never been brought before the mining fraternity, or received any publicity whatever.

To Mark a Brown Print White

As to what solution would mark a vandyke white, Edward Godfrey says the following in *Engineering News,* Dec. 14, 1916: I wanted to know this myself a short time ago, so I went into the laboratory and tried soda, ammonia carbonates, acids and peroxide, but could find no single solution that would bleach out the brown. In drawing lines with the pen, however, I discovered that at the intersection of some of them the print turned white. A mixture of the solutions which made these lines was made and a clear white surface was left under brush or pen. The two substances are hydrochloric acid and peroxide of hydrogen. No treatment seemed to be needed after applying the solution.

An Isolated Gas Plant

A plant for the generation of illuminating gas is being manufactured by the Tirrill Gas Machine Lighting Co., 103 Park Ave., New York. The plant consists of a generator, exhaust blower, air pump and the necessary piping. Its use in small isolated plants should prove advantageous where an electric lighting system is not feasible. A surface plant, illuminated by gas, is safer and more efficient than one depending on the uncertainty of oil lamps.

Owing to the possibility of nitroglycerin leakage from dynamite, due to its improper storage, there is danger in making any use of empty dynamite boxes. They should be burned without being knocked to pieces or split, as the wood having absorbed nitroglycerin is likely to be explosive. They should not be burned in a stove, as serious accidents have been known to happen from this cause.

Details of Milling and Smelting

Effect of Arsenic on Brass

The question of the extent to which arsenic is detrimental to brass was taken up by C. H. Mathewson and E. M. Thalheimer in a paper before the autumn meeting of the British Institute of Metals in London in September. According to *Iron Age*, Nov. 30, 1916, the authors gave the results of experiments on the annealing of three arsenical brasses containing 62.5% of copper low and high in arsenic (0.024%, and 0.120% respectively) and 61% of copper, high in arsenic (0.139%).

In the mechanical tests made after annealing and quenching at various temperatures between 450 and 750° C., the arsenical brass was found superior throughout in elongation and strength. Thus, when quenched at 550° C. the arsenical brass gave a tensile strength of 49,400 lb. per sq.in., with an elongation of 77.5% in 2 in., while the corresponding figures for the other alloy were 48,300 lb. per sq.in. and 74.25% respectively. On the other hand, the contraction of area of the arsenical brass, after annealing at a high temperature followed by quenching, was a little the lower of the two; and in all cases the arsenical brass was the better under conditions of less sudden cooling. The alloy with the smaller percentage of copper was less sensitive than the higher alloy to variations in the rate of cooling.

The authors consider that, given proper annealing, arsenical brass is stronger and more ductile than that from electrolytic copper and that it will stand severe hot and cold working. For brass containing 60% of copper and intended for cold working, they recommend that annealing at temperatures above a moderate red heat should be followed by cooling at the rate of about 20° C. per min., down to a temperature approximating 450° C. Still slower cooling (50° C. per min.) is advised when the proportion of copper is higher, quenching in running water being permissible when the temperature has fallen to about 550° C.; but if the cooling is effected more quickly than the first-named rate, it should proceed until 450° C. or an even lower temperature is attained. The results of the tests are set out in a number of tables and curves.

In discussing the paper Dr. Hudson rather doubted that the results would establish complete confidence in arsenical brass, for though it was shown to give material with good tensile properties, other tests, such as the drop test, were required. The banded structure was not infrequent in copper-zinc alloys and probably depended on the size of section rolled. The prevention of zinc diffusion by the arsenic was an effect which seemed to be produced by impurities generally, nickel having a similar effect in copper-zinc-nickel alloys.

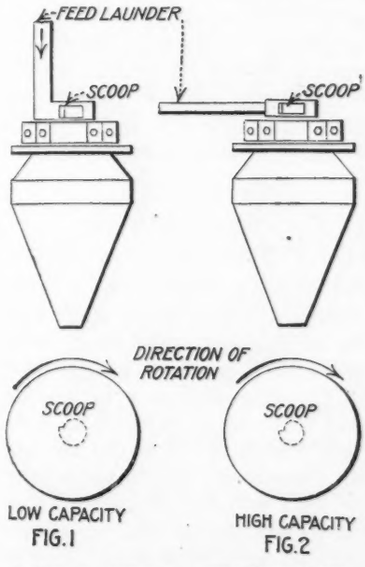
Mr. Murray regretted that the authors had not used standard alloys free from arsenic. Manufacturers at present are compelled to use brass of doubtful origin, frequently containing arsenic from mixed grades of scrap copper. He himself had found that sheets with 0.03% arsenic gave better tensile results in practice than pure metal; but the results of an increase in arsenic content, due to scrap returns, had taught him to have nothing to do with arsenic. As a rapid method of detecting the presence of arsenic in brass, he had found the Muntzmetal fracture test very satisfactory, cold-worked specimens in particular exhibiting a characteristic yellow fracture all over.

Professor Turner emphasized the desirability of employing shock or alternating tests and wished that authors had tried a wider range of specimens, with an arsenic content from zero upward.

Dr. W. Rosenhain pointed out an analogy between the effects of arsenic in brass and those of phosporus on the diffusion or solution of carbon in steel, and also drew attention to the fact that when lead and arsenic were present together they gave results differing from those produced by either singly. He thought the authors' temperature determinations were not accurate and that they had built too largely on insufficient foundations. Professor Huntington said that work on the lines adopted by the authors was very badly needed and that numerous experiments ought to be carried out with material containing small quantities of impurities.

Increasing Ball Mill Capacity

In a Western milling plant where a Hardinge ball mill was used to reduce the size of ore after coarse rolls, it became necessary to install a second mill to increase the grinding capacity. The feed to the first mill entered the scoop-box at right angles to the direction of rotation of the mill, as shown in Fig. 1. When the second unit was installed, owing to the restricted floor space available, the feed launder conducted the feed to the scoop-box as shown in Fig. 2. It immediately became apparent that the grinding capacity of the plant was considerably more than doubled, and upon ore of medium hardness the second mill alone had sufficient capacity to supply the rest of the plant. As the two machines were identical in all other respects and each received the same kind of feed, it was evident that the difference in grinding capacity was due to the difference in direction of feed-flow to the scoops.



FIGS. 1 AND 2. SHOWING INCREASED CAPACITY WITH CHANGE OF LAUNDER

The feed to the second mill flowed into the box at a considerable velocity and straight into the scoop mouth as it moved on that portion of its revolution through the feed, consequently more ore was actually forced into this mill than into the first, and a greater grinding capacity was the result.

Of course there would necessarily be a limit to the increase in grinding capacity of the mill with increase of feed, but the indisputable fact that such an increase took place in this instance suggests that possibly, on account of insufficient crowding, some other mills are not operating at capacity and that perhaps some experiments along this line would be profitable.

Some Notes on Lead Smelting at Tooele, Utah

The sintering equipment at the International Smelting Co.'s works at Tooele, Utah, comprises 10 Dwight & Lloyd sintering machines, each 42x264 in. As installed, these machines had a pallet travel of 13 in. per min., the tonnage per machine-day varying from 90 to 120 tons, average sulphur content of the charge was 14.6%; average sulphur content of sinter, 5.2%. The physical condition of the product was good.

Several attempts to increase the tonnage by increasing the speed of pallet travel to a maximum of 18 in. per min. were accompanied by poor sinter and high sulphurs. In spite of this experience an attempt was made with what was considered a maximum pallet travel, or 27 in. per min., with results that were highly satisfactory both as to quality and quantity of sinter. This speed is now maintained, the average tonnage per machine-day is 223, and at times runs up to 245 tons. The sulphur content of the feed is 11.8%, and of the product 3.18%. The average sulphur in the feed for the first six months of 1916 was 11.47%, and of the sinter produced, 2.88%. Referring to the tonnage per machine-day, this is gross tonnage; 18.84% of this tonnage is screened out of the sinter as fines and returned to the receiving bins of the sinter plant. These screenings are obtained by the sinter dropping from the end of the machine on a ½-in. grizzly and is for the most part dust, analyzing approximately 7% sulphur.

Greater Furnace Efficiency Obtained with Double-Tier Jackets

In the lead department of this works, there are five blast furnaces, each 54x180 in. at the tuyeres. Each furnace has 25 tuyeres, 4 in. in diameter. The depth from charge floor to tuyeres is 24 ft. 8 in.; from charge floor to bottom of crucible, 30 ft. Experiments with various widths of furnaces varying from 45 to 60 in. have been tried, with the final result that a width of 54 in. has been adopted as standard. Four of the five furnaces have two tiers of jackets; the fifth will be changed to this construction when the opportunity offers. The upper tier of jackets is placed vertically, as it was found that if the bosh of the lower jacket was continued, the crusts were not so readily removed.

The first installation of upper jackets at this plant was in 1913. The following data referring to the installation of the upper tier of jackets may be of interest: Volume of water passing through jackets in gallons per minute per furnace-day, 159; increase of temperature of water passing through upper tier of jackets, 11.3° F.; average cost of each barring down of a furnace and repairs to brickwork—double tier of jackets $284.67, single tier of jackets $607; average time occupied in each barring down and repairing brickwork—double tier of jackets 2.57 days, single tier of jackets 4.59 days; reduction in tonnage efficiency due to time lost per year—double tier of jackets 1,659.3 tons, single tier of jackets 2,268 tons.

Tuyere in Back End Jacket Decreased Crusts

Another feature of blast-furnace construction is the addition of a tuyere in the center of the back-end jacket. By bushing the two tuyeres on each side jacket, immediately adjacent to the end jacket to one-half their original diameter, the effect of the end tuyeres is noticeable in decreased formation of crust.

The International smeltery was probably the first lead plant to discard the bedding of ores, so long considered necessary in lead-smelting practice. This was accomplished by the application of weighing hoppers under each bin and some minor modification of standard equipment. The new system was adopted on the suggestion of Henry N. Thomson, then superintendent of the Tooele plant, but now metallurgist for the United Verde Copper Co. at Clarkdale, Ariz. Mr. Thomson had seen the weighing hoppers in use at the copper smeltery of the Old Dominion company at Globe, Ariz., and decided to try them for making up the lead-furnace charges at the International smeltery. The mechanical details were worked out by L. T. Sicka, mechanical superintendent at the Tooele works. The installation of this system of making up the charges dispensed with a horde of chargewheelers, whose places have always been exceedingly difficult to fill during periods of scarce labor.

The tonnage per furnace-day averages approximately 300 tons of gross charge. No slag shells are returned, which practice was established in 1915. There is, however, included in this gross tonnage the secondaries resulting from the repairs to forehearths. Automatic sampling of a large volume of slag and slag shells over a considerable period gave the results shown in the accompanying table. After figuring handling and smelting cost together with the recoverable metal in the slag shells, it was apparent that there was no economy in resmelting. With the removal of slag shells from the charge, the coke percentage dropped from 12.92% to 10.76%. The furnaces are operated with double forehearths, the resultant slag assaying as follows: Pb 1.17%, Cu 0.23%, Ag 0.37 oz., Au. 0.001 oz., SiO_2 30.93%, FeO + MnO 38.87, CaO 15.22, ZnO 7.93%.

ANALYSES OF SLAG AND SLAG SHELLS AT TOOELE LEAD SMELTERY

	Pb, %	Cu, %	Ag, Oz.	Au, Oz.
Original slag	1.1	0.28	0.31	Trace
Slag shells	1.4	0.62	0.70	Trace
Original slag	0.7	0.20	0.38	0.005
Slag shells	1.2	0.39	0.85	0.005

The converting of the leady copper, described by O. M. Kuchs,[1] is still in satisfactory operation, treating a lead matte of the following composition: Pb 15.7%, Cu 10.2%, Ag 19.3 oz., Au 0.05 oz., and giving a fume assaying: Pb 58.8%, Cu 0.67%, Ag 4.78 oz., Au 0.012 oz. The recovery of lead in the form of fume is approximately 97%.

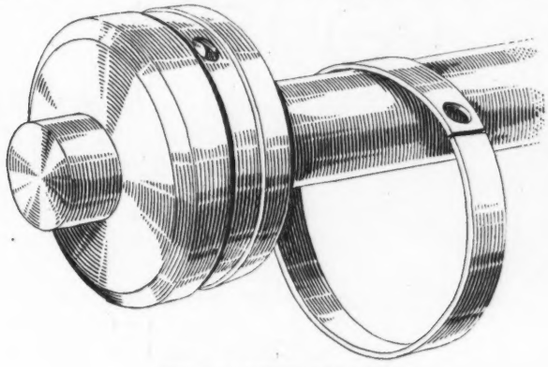
[1] "Trans. A. I. M. E.," Vol. 49.

Kinks for the Mine Shop

Safety Collar

By J. E. Cooley*

An easily made safety collar that can be used on the end of shafting, etc., is shown in the accompanying illustration. It consists of a round cast-iron collar having a groove in the center, in which is placed a loose-fitting



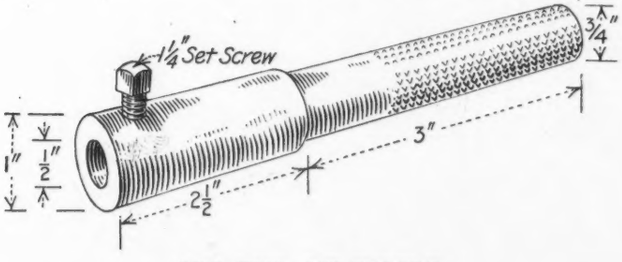
THE SAFETY COLLAR

flat steel spring. A hole is made in the spring through which to insert a screwdriver. The hole is turned away from the screw after the screw is tightened. The spring serves as a guard for the screw, and at the same time it will instantly stop if anything comes in contact with it.

Holder for Grinding Tool Bits

By Herbert M. Darling†

With ordinary care the average tool holder should last almost indefinitely; but in most shops one finds tool holders that show abuse at the hands of the men using them. The worst abuse probably is caused by the com-



THE TOOL BIT HOLDER

mon practice of grinding the high-speed tool bits when they are in place in the holder. While grinding in this way the operator will usually strike the holder itself against the emery wheel, and after this has been done enough times the head of the tool holder will be badly ground, especially right under the tool seat.

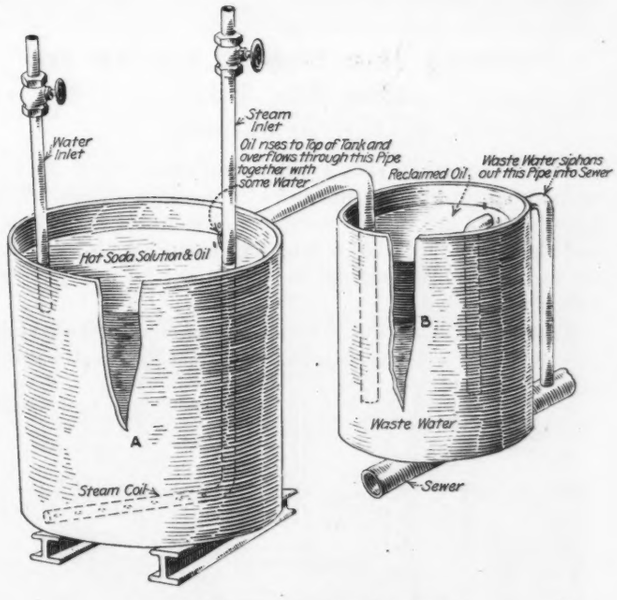
The operator can hardly be blamed for this. If he attempts to hold the high-speed bit in his fingers while grinding, he cannot apply the necessary pressure to grind it quickly without it becoming unpleasantly hot.

To overcome this trouble I use a holder, as shown in the illustration, which will hold tools up to ⅜ in. square. This holder can be made in a few minutes from an odd piece of machine steel by an apprentice. In use the tool to be ground is inserted in the ½-in. hole and secured by the setscrew. It can then be ground in a businesslike manner without loss of time or the danger of burning the fingers or marring a tool holder.

Method of Reclaiming Mineral Cutting Oil

By P. G. Little*

In shops which have automatic lathes and screw machines it is necessary to use a large quantity of cutting oil on the work, and in most shops of this kind the oil that is carried away on the finished parts and washed off is wasted. The sketch shows an arrangement for washing the parts and reclaiming the oil. This method has



THE RECLAIMING OUTFIT

been adopted in a large machine shop with several automatic machines. About 25 gal. of oil, formerly wasted, is reclaimed every week at this factory, and the reclaimed oil is used on drilling and similar work.

As shown in the sketch, the tank *A* is filled with a solution of soda and water for cleansing purposes and is fitted with a water inlet and steam coil. The parts to be washed are placed in a wire basket and dipped into the solution. The oil that is washed off rises to the top of the tank and

*Hartford, Conn.
†Greenfield, Mass.

*Kenosha, Wis.

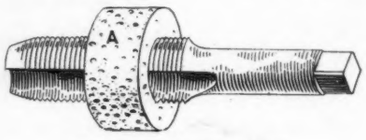
passes through the overflow pipe, together with some of the solution, into the tank *B*. In the tank *B* the oil naturally rises to the top and is removed in buckets. The waste solution, which remains at the bottom of the tank, siphons through the outlet pipe into the sewer. Except for removing the reclaimed oil the process is automatic, and the quantity of oil reclaimed has made the installation well worth while.

The illustration shows the arrangement at this plant, but of course many modifications can be made to suit existing conditions. Mineral cutting oil does not combine with the soda and saponify, as would animal or vegetable oil, which would negative the results.

Simple Depth Gage for Tapping

By William Roberts*

A blind hole is very hard to tap unless the machine has an attachment that will reverse automatically. If a few holes have to be tapped to various depths, the attachment is useless. If one tries to machine tap the hole by guesswork, the tap is apt to be broken. The cork *A* is adjusted to approximately the right depth; and when it touches the surface of the work, the machine is reversed. The cork being flexible, if the tap goes in a thread more than intended no harm is done, as there is nothing to break.



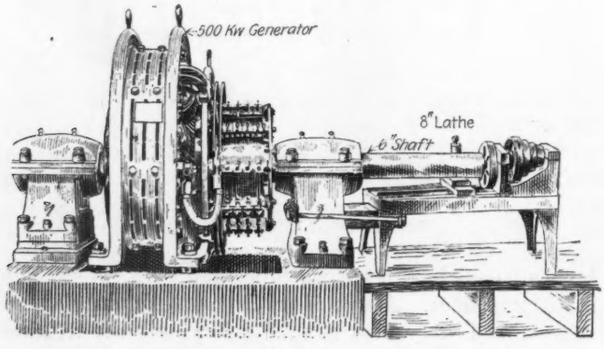
THE TAPPING GAGE

Taking the Small Lathe to the Big Job

By J. K. Arrowsmith†

The illustration shows what happened when I was called upon to turn up the end of a generator shaft. The machine was out in the country and weighed many tons, and there was no lathe in town big enough to take in the job; so instead of putting the job in the lathe I put the lathe in the job.

The lathe I used was a small one and was clamped to the generator. The center in the shaft was put on the lathe center, and the lathe was then lined up with the job. I drilled the end of the shaft and put in a capscrew through the face plate to hold the center in the center of the shaft.



HOW THE SHAFT WAS TURNED

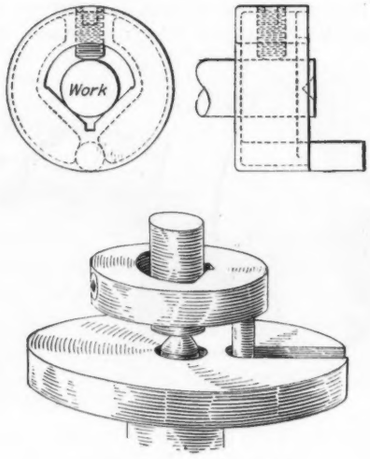
*Springfield, Mass.
†North Yakima, Wash.

The generator had to be turned by hand as power would have been too fast, but six hours did the job and two laborers took turns rotating the generator shaft. Instead of the work costing about $100, it cost only about $10.

Simple and Easily Made Safety Lathe Dog

By Joseph V. Dolan*

The accompanying illustration shows a safety lathe dog which consists of a cast drum and socket screw for clamping the work. I think this could be made lighter and cheaper than most safety dogs now on the market.

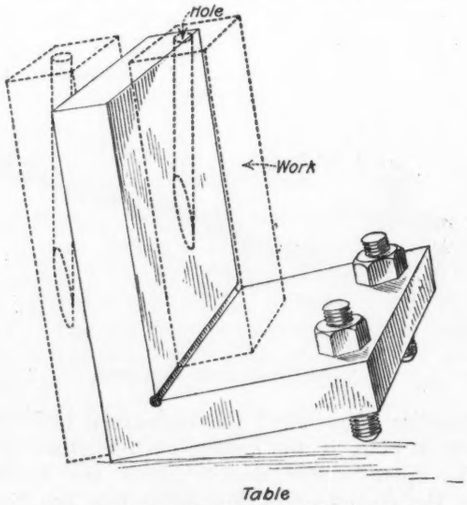


SAFETY LATHE DOG

Simple Adjustable Angle Plate

By William Roberts†

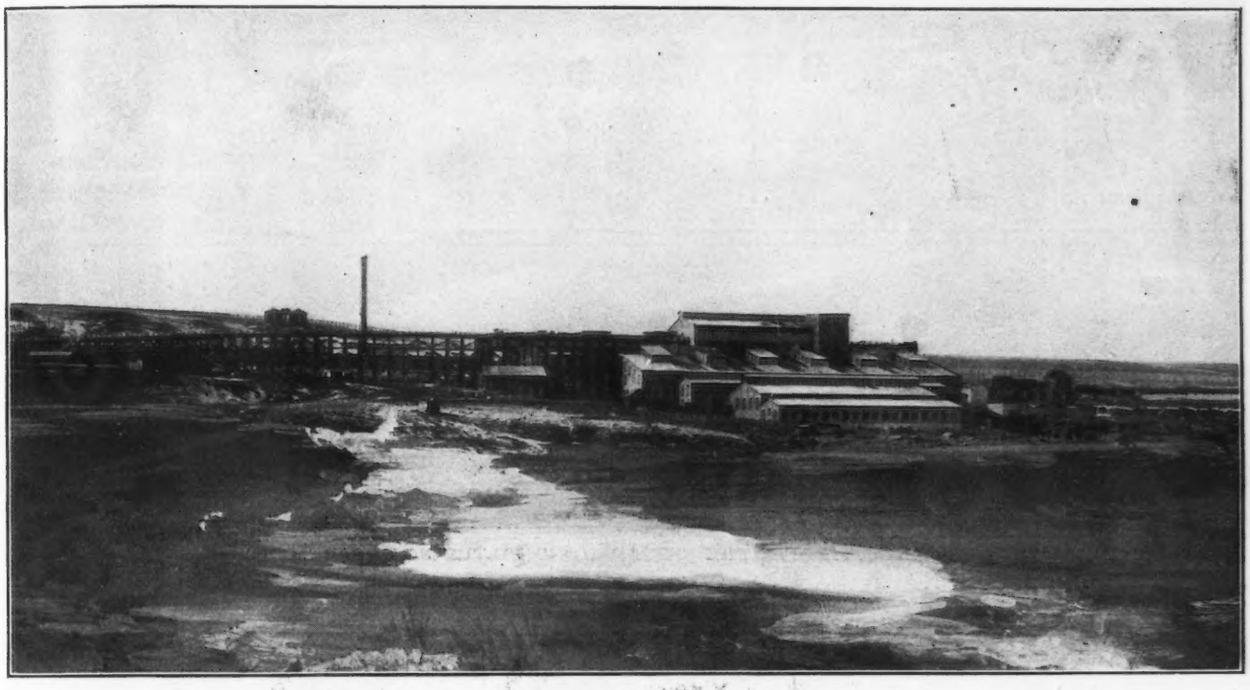
The accompanying illustration shows a tool that we find quite handy on the drilling machine for drilling holes at various angles. It will be noticed that the adjustment is secured very simply by means of the two studs and clamping nuts.



SIMPLE ADJUSTABLE ANGLE PLATE

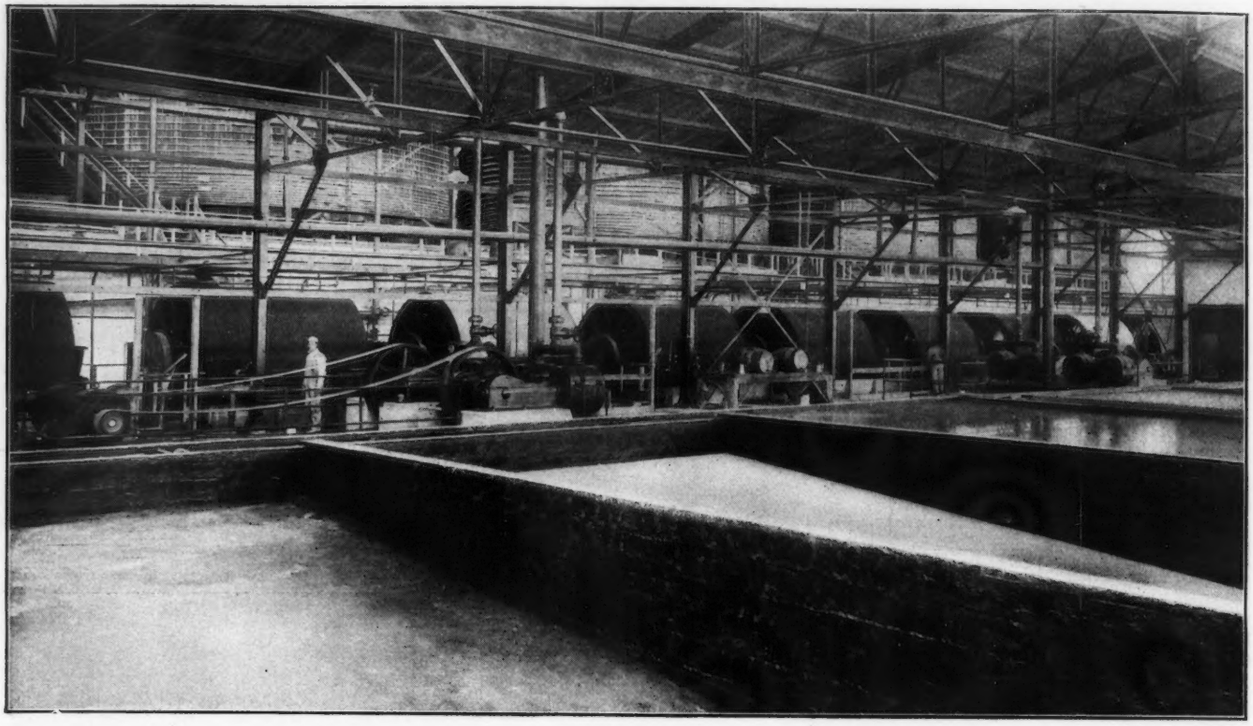
*Ardmore, Penn
†Springfield, Mass.

Anaconda's Electrolytic Zinc Plant

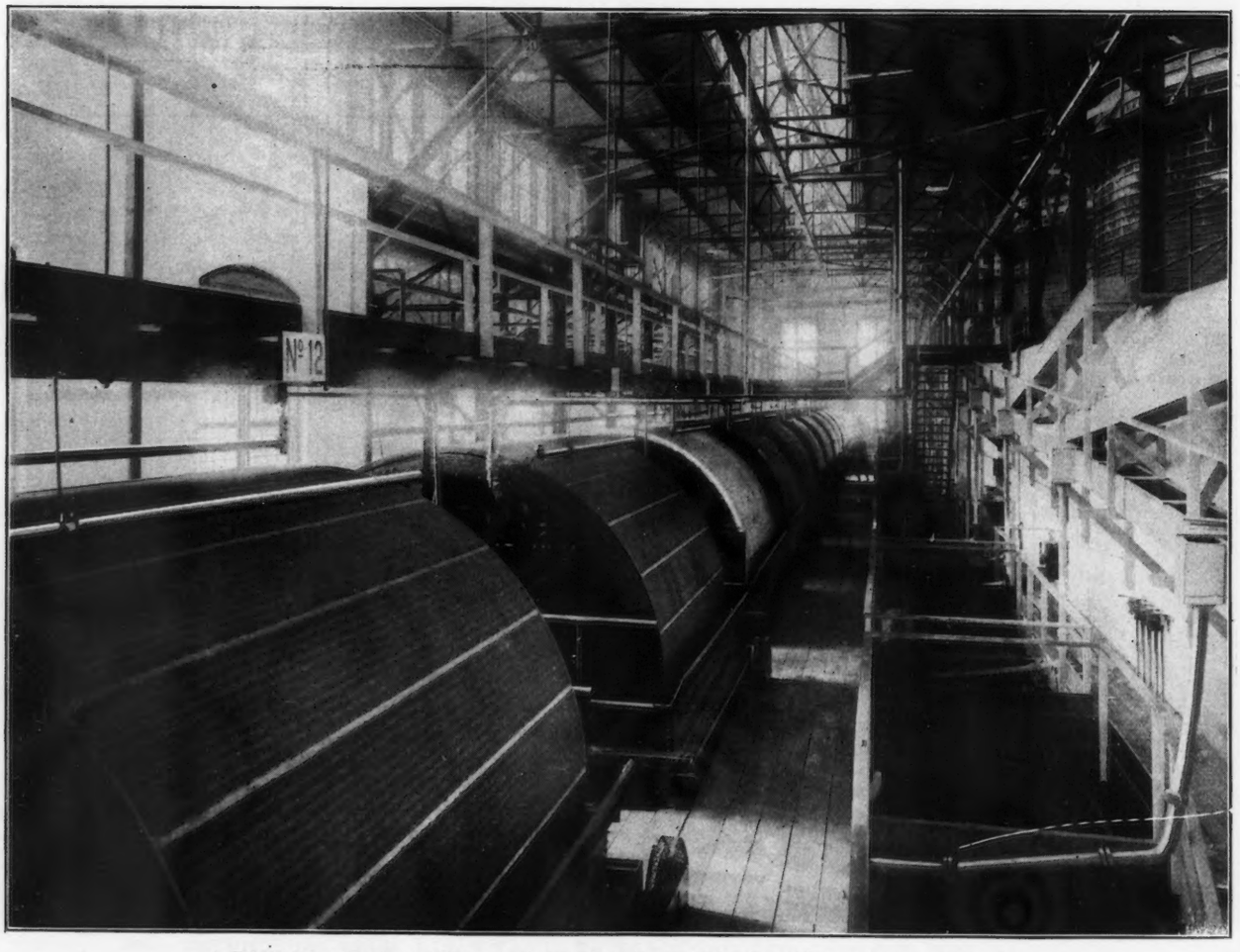


VIEW OF ELECTROLYTIC ZINC PLANT FROM THE WEST

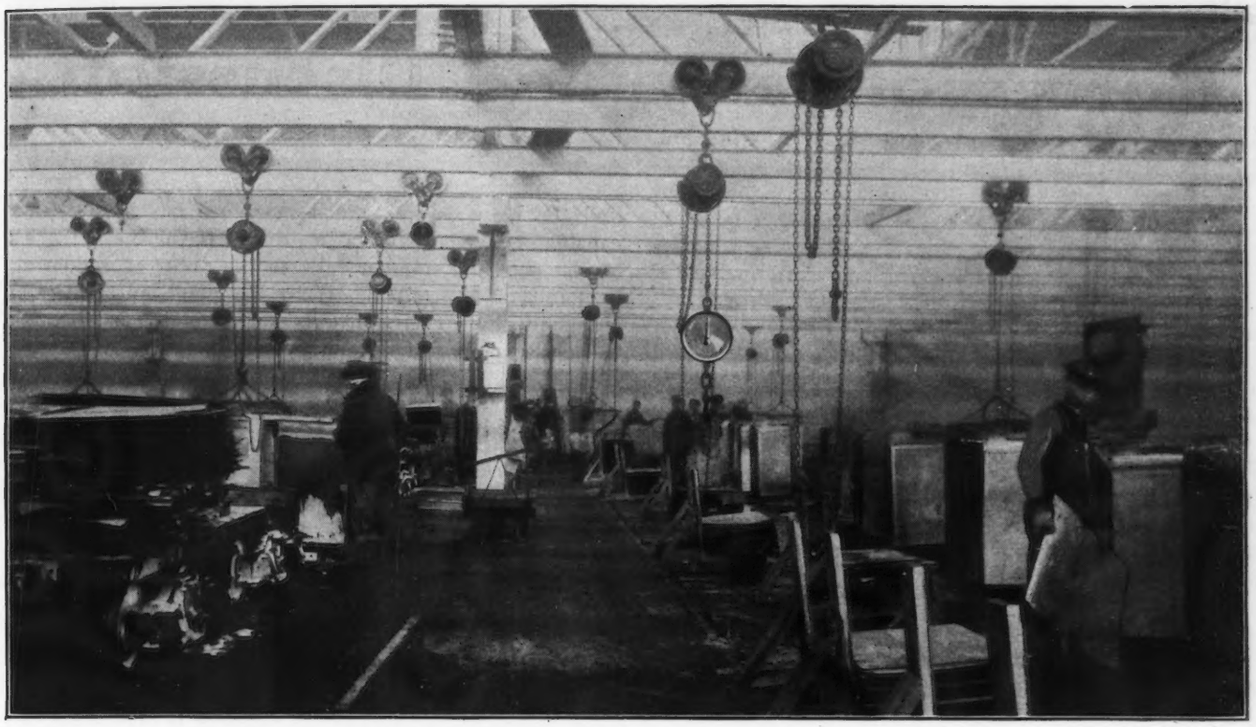
ANACONDA'S NEW ELECTROLYTIC ZINC PLANT AT GREAT FALLS, MONT.—NORTHWEST SIDE



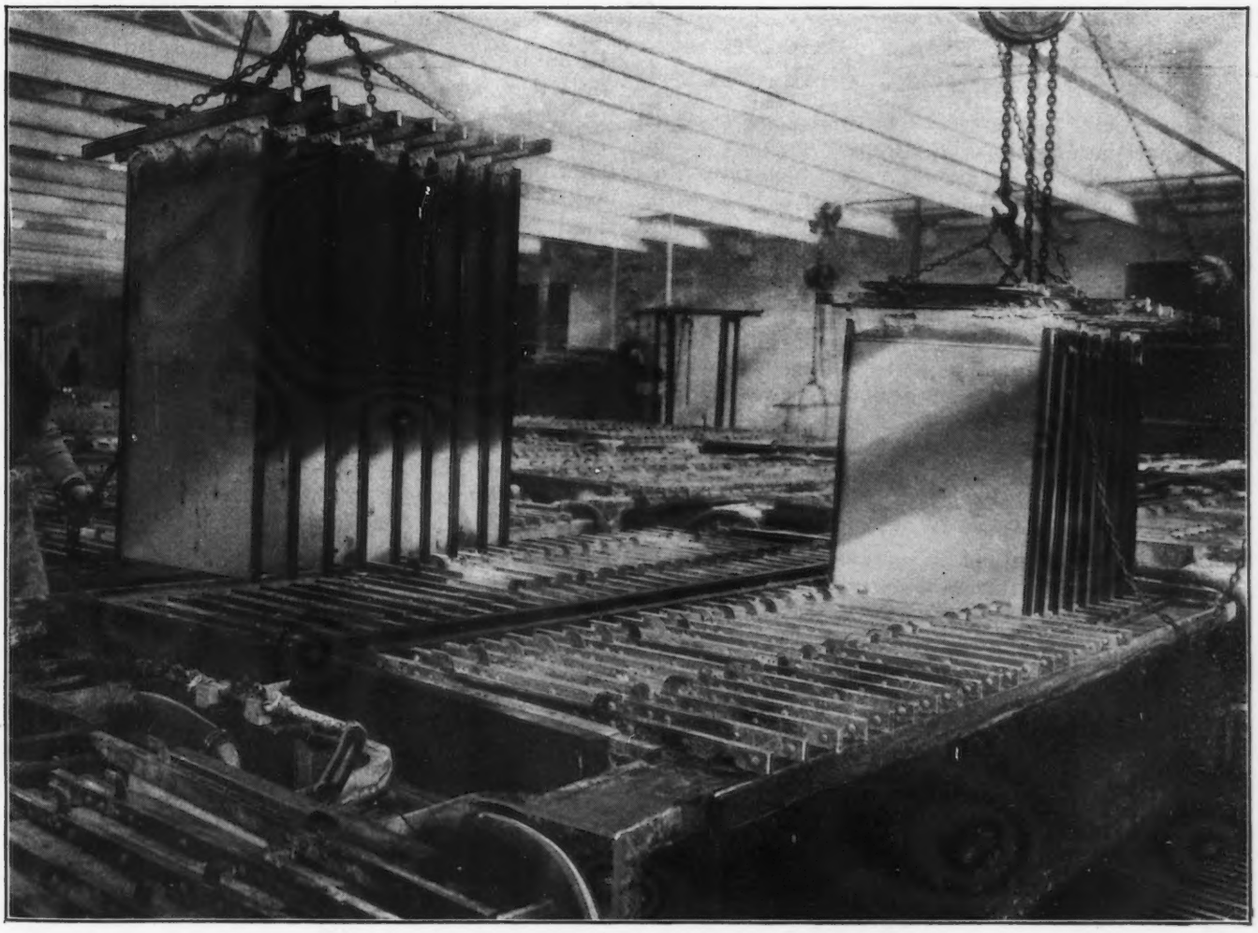
ANOTHER VIEW IN THE SETTLING AND FILTERING DEPARTMENT



A ROW OF FILTERS AT THE ELECTROLYTIC ZINC PLANT AT GREAT FALLS



STRIPPING ZINC SHEETS AT ANACONDA'S NEW PLANT AT GREAT FALLS, MONT.



DRAWING ZINC CATHODES FROM THE ELECTROLYTIC CELLS

Correspondence and Discussion

Early Flotation Practice by the Jemez Indians

In view of the numerous chronologies of flotation which are being published, the following item is of interest.

While making an examination recently of property on the Jemez River, New Mexico, I observed at the pueblo of the Jemez Indians that the ceremonial boards worn by squaws in various dances were painted with a remarkably beautiful shade of green. Inquiry among the Indians disclosed the fact that this green paint is obtained by crushing sandstone containing malachite and subsequent boiling of the sandstone in pine pitch. The pine pitch is gathered in considerable quantity for this purpose. The froth resulting from the boiling is skimmed off and carries all the particles of copper carbonate originally contained in the sandstone. The froth, while still warm, is used as paint.

I was informed that green paint had always been obtained in this manner. The word "always" is somewhat indefinite, but the process has been used for generations among the Indians of this pueblo.

Albuquerque, N. M., Dec. 13, 1916. S. O. Andros.

Valuation of Mine Plant and Depreciation Assessment

In determining the actual value of a going mine or of a defunct mining property, a mining engineer should possess the instinct of a dealer in "used" motor cars, the insistence of a Shylock, the skepticism of a Missourian, the probity of a judge and the retainer of his client. In short, he should be a mining engineer and not a mere *mining expert*. An item that may involve some careful study and that is quite certain to promote considerable discussion is that of mine plant.

In the case of defunct properties, often classified as moribund if any pretense of exploitation persists, the problem may be easy. Properties long idle should be regarded as *de facto* defunct. The equation for the valuation of mine plant may be expressed, in such cases,

$$x - y - z = V$$

in which x = scrap value at market, y = cost of dismantling, z = freight and V = value. When the sum of y and z exceeds x, the value is negative, but may be assumed as 0 unless the stuff is in the way.

In giving advice regarding the actual scrapping of the junk, due attention should be paid to the value of individual items of the plant when $z = 0$ and y approaches 0; that is to say, whether the individual item can be used in rehabilitating the mine.

In the case of going mines the actual present value of a mine plant, in its entirety, bears no direct relation to first cost less depreciation already assessed. Its true value depends upon the ore reserves of the mine plus the scrap value at the time when the reserves, capable of economic treatment by the plant, are exhausted. If the mine has no ore reserves, it has ceased to be a mine and the plant is junk until more ore has been found, capable of being treated at a profit. If the market price of the potential product falls to the point of rendering exploitation unprofitable, the mine plant automatically enters the junk class until its former status is restored, or irreclaimably lost, by subsequent fluctuations.

T. Montmorency Dillon.

New York, Dec. 14, 1916.

Not Always a Wildcat

The letter appearing under the caption, "Not Always a Wildcat," in the *Journal* of Dec. 2 contains something, as stated in the editor's note. Too often is the prospect "turned down" because it has no ore blocked out. But there is another side to the question, and Mr. Lord, should he make inquiry, would find that if all those properties which had been turned down and had subsequently made good were placed on the black side of the ledger, and those that had been opened and then failed were placed on the red side, his ledger would be mainly in the red.

When ore has been developed in commercial quantities, it is comparatively easy to secure money for its extraction, but there is far less available for the risks involved in prospecting. There are relatively few mines with substantial ore reserves that are in need of funds for extraction, while there are countless thousands of prospects asking for funds for their development.

The individual or organization that has funds for the latter purpose would soon be bankrupt if it undertook to open the tenth part of the projects offered for consideration. In order to live and to continue in this field of mining activity, the financial manager must be extremely careful, and he will invest the funds of his principals only where he believes the chances for making a mine are excellent—a fair run for his money is scarcely enough. He wants something even better than this, for he knows that when using the best of judgment, he will draw many more blanks than prizes. Of course, in following this method of procedure, one may miss something good, but this is the exception and not the rule.

Mr. Lord's experience has been exceptional if all the men whom he has met while examining prospects have called them wildcats. Many a prospect is turned down with no thought except that the examining engineer sees nothing in it that appeals to him. The term wildcat is generally reserved to apply only to those instances that are associated with fraud.

When certain representations have been made which the engineer finds totally erroneous, he is very likely to think wildcat if he does not say it.

Engineers, like other mortals, are not inclined to publish their mistakes or to tell of the prospects recommended that have failed to make good, but I venture to say that among those engineers who have had occasion to do much of this work, there are few who have not a long string of failures to their credit—much longer than their successes.

New York, Dec. 5, 1916. F. F. Sharpless.

Minerals Separation Decision

WASHINGTON CORRESPONDENCE

That there will be less cause for complaint of the business policy of Minerals Separation, Ltd., and its American subsidiary in the future is an opinion held here by metallurgists who travel widely among the country's mining districts. Prior to the litigation, which ended last week when the Supreme Court of the United States handed down a decision favorable to the Minerals Separation companies, there was some discussion of the conduct of the patentees of the most successful process of flotation that has been devised. Not only had the English syndicates placed royalties at a figure considered high, according to a generally held opinion here, but they seemed to impose conditions that tended toward a hostile feeling among American operators. When the validity of their patent came into question, a more generous spirit at once marked the business policy of the English companies. American operators have been treated well, and objectionable features in the original contracts have been eliminated almost entirely. It is believed here that the advantage of this policy, as compared to the one that characterized previous operations of Minerals Separation in this country, have been brought home to the management of the companies and that there will be no cause for complaint in the future.

The Supreme Court, in its decision, upheld claims Nos. 1, 2, 3, 5, 6, 7 and 12.

Claim No. 1 consists in: (a) Mixing the powdered ore with water; (b) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore); and (d) separating the froth from the remainder by flotation.

Claim No. 2 consists in: (a) Mixing the powdered ore with slightly acidified water; (b) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore); (c) agitating the mixture until the oil-coated mineral matter forms into froth; and (d) separating the froth from the remainder by flotation.

Claim No. 3 consists in: (a) Mixing the powdered ore with slightly acidified water; (b) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore); (c) warming the mixture; (d) agitating the mixture until the oil-coated mineral matter forms into a froth; and (e) separating the froth from the remainder by flotation.

Claim No. 5 consists in: (a) Mixing the powdered ore with water; (b) adding a small proportion of oleic acid amounting to 0.02-0.5% on the ore; (c) agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith; and (d) separating the froth from the remainder by flotation.

Claim 6 consists in: (a) Mixing the powdered ore with water containing a fraction of 1% of sulphuric acid; (b) adding a small proportion of oleic acid amounting to 0.02-0.5% on the ore; (c) agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith; and (d) separating the froth from the remainder of the mixture by flotation.

Claim No. 7 consists in: (a) Mixing the powdered ore with water containing a fraction of 1% of sulphuric acid; (b) adding a small proportion of oleic acid amounting to 0.02-0.5% on the ore; (c) warming the mixture to 30 to 40 deg. C.; (d) agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith; and (e) separating the froth from the remainder of the pulp by flotation.

Claim 12 consists in: (a) Coating the minerals with oil in water containing a fraction of 1% of oil on the ore; (b) agitating the mixture to cause the oil-coated mineral to form a froth; and (c) separating the froth from the remainder of the mixture.

In claims Nos, 2, 3 and 12 it will be noticed that the amount of oily liquid is specified as a fraction of 1%. In claims Nos. 5, 6 and 7 the amount of oleic acid is specified as being 0.02-0.5%.

Claims Nos. 9, 10 and 11 were found invalid by the Supreme Court.

Claim No. 9 provides for the separation of the mineral from the gangue by: (a) Coating the mineral with water containing a small quantity of oil; (b) agitating the mixture to form a froth; and (c) separating the froth.

In No. 10 the separation is provided for by: (a) Coating the mineral with oil in water containing a small quantity of oil; (b) warming the mixture; (c) agitating the mixture to form a froth; and (d) separating the froth.

In claim No. 11 separation is provided for by: (a) Coating the mineral with oil in water containing a small quantity of oil and a quantity of acid sufficient to cause chemical action on the metalliferous minerals present; (b) agitating the mixture to form a froth; and (c) separating the froth.

One of the features of the opinion which has called forth considerable comment in Washington is the skillful manner in which the court reached its conclusion without delving into the intricacies of the process. Transcript of the records presents so many technical metallurgical questions involved that the attorneys were appalled at the complicated nature of the case which they were called upon to discuss intelligently. The briefs are so technical as to call forth comment from counsel and jurists alike.

This interesting deduction from the record in the case is made by the Supreme Court in its opinion:

> The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation, it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining countries of the world, notably in the United States, Australia, Sweden, Chile and Cuba, and that because of its economy and simplicity it has largely replaced all earlier processes. This, of itself, is persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect.

One of the arguments of the defendant was disposed of by the court as follows:

> The claim that the patentees of the patent in suit are not the original discoverers of the process patented because an employee of theirs happened to make the analyses and observations which resulted immediately in the discovery cannot be allowed. The record shows very clearly that the patentees planned the experiments in progress when the discovery was made, that they directed the investigations day by day, conducting them in large part personally, and that they interpreted the results.

Much stress was laid by the defense on the question discussed by the Court in the excerpt about to follow. This expression of the Court is also expected to have an important bearing on the Rittman and other patents where efforts are being made to interpret the patent laws so as to eliminate variation of treatment. With regard to this phase of the case the Court says:

Equally untenable is the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances, and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law.

Copper Replaces Aluminum for Electric Transmission Line

One of the aluminum transmission lines from the Madison River power plant of the Montana Power Co. to Butte, a distance of about 60 mi., is now being scrapped, and the electric current formerly carried by the aluminum will be transmitted through a copper line. The aluminum line had been in operation for 15 years, and the line as a whole had reached a condition where maintenance charges were high, owing to the aluminum wire becoming worn in the ties and giving considerable trouble from breakage.

General Manager F. M. Kerr, of the Montana Power Co., states that the following reasons caused his company to adopt copper instead of aluminum for long-distance transmission lines: (1) Aluminum is softer and weaker and particularly susceptible to abrasions at points of support. (2) Aluminum has a low melting point and is easily burned in two and destroyed by arcs. (3) Where the wires are supported on suspension insulators, side swinging to the wind must be considered. Aluminum is at a great disadvantage in this respect, and on account of its light weight and large area, will swing up into close proximity to the crossarms, cutting down the necessary clearance to a dangerous extent. (4) Fire hazard and danger to human life are greater with aluminum on account of its liability to burn in two, drop to the ground and set fire to whatever it touches. The ends of the wire will burn free from the ground and hang down as a menace to human life.

Previous to the summer of 1915 there were in operation three 50,000-volt transmission lines from the Madison plant to Butte, consisting of two 77,000-circ. mil aluminum lines on wooden poles and one No. 0 copper line on steel towers. During the last summer a portion of the tower line was reinsulated for 100,000-volt service in order to serve power to the St. Paul Railway.

In view of the fact that it was apparent that the aluminum lines would have to be abandoned within the next few years, it was decided to complete the reinsulation of the tower line to the Madison River plant for 100,000 volts and dispense with the other lines for the present.

The statements made in the daily press that the aluminum line had been adjudged a failure is not entirely correct, according to Manager Kerr, who writes: "We realize and admit that a successful line can be constructed of aluminum, but as before stated, our experience and observations have placed us on record as favoring copper. While the scrap value of aluminum at this time is high, this fact had little to do with our decision. We were well satisfied that the aluminum lines would have to be abandoned within a year or two in any event, and the only effect the high price had was to hasten this work a little."

Enforcement of Mining Contracts

By A. L. H. Street*

In the law there is a doctrine known as "Specific Performance," under which the courts frequently compel one to carry out a contract under which he has agreed to convey real estate or transfer corporate shares. Some of the limitations on this legal remedy are indicated in a recently handed down and interesting decision of the United States Circuit Court of Appeals, Ninth Circuit, in the case of Ellis vs. Treat, 236 Federal Reporter, 120.

In dismissing this suit, which was brought to compel performance of a contract to convey mining claims to a corporation to be performed and to deliver to plaintiff a percentage of the stock, the court holds that the contract was too indefinite to be enforced, since it did not fix the amount of the capital stock of the proposed corporation, the number or value of the shares, the number of directors, the place of its business or its powers or duration. Relief was denied on the further grounds that plaintiff did not show his ability to resell part of the shares, for use of the proceeds in development work, as contemplated by the agreement; and that plaintiff had failed to show that he did not have an adequate remedy against defendant by suit for damages for breach of the contract; it being a fixed rule of law that specific performance in such cases does not lie when there is an adequate remedy by an action for damages.

Mexican Mining Taxes

Important progress has been made recently with regard to the proposed mining taxation in Mexico, and a new schedule of taxes has been agreed upon by Luis Cabrera, Secretary of the Treasury for Mexico, and the committee representing 45 principal American and foreign mining companies. This new schedule is the result of the protest of the mining companies against the taxes announced in the decree of May 1, 1916. These taxes many foreign operators refused to pay on the ground that they were illegal and confiscatory; they provided a 10% ad valorem tax on gold and silver and a 5% ad valorem tax on the metal content of copper, lead and zinc. ores.

The mining companies first took up the tax problem with the American Conference Commission but Mr. Cabrera, declining to discuss the matter in the conference, took the question up directly and eventually agreed to forward and recommend a new schedule to the *de facto* government. It was expected that the new schedule

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would go into effect on Jan. 1, 1917, but a dispatch from Queretaro to Washington announces that a decree of Dec. 10 suspended the old metal export taxes until Dec. 31, 1917, during which period taxes will be assessed under a new schedule. The principal features of the new tax schedule, as proposed, were as follows:

Gold and Silver—If in the form of ore, 7% ad valorem, and 5% ad valorem if in the form of bullion or if contained in bullion.

Copper in Matte or Bullion—When the New York price is 20c. per lb. or lower, the tax will be 4% ad valorem on the full content. When the price is 20.01c. or higher, the tax will be 5% ad valorem.

Copper in Ore—The tax on copper in ore will be 20% greater than the tax on copper in matte or bullion; in other words, 6% ad valorem when the price of copper is over 20c. and 4.8% when copper is 20c. or less at New York.

Lead—On the full metal content a tax of 3% ad valorem is to be levied, the value to be determined by taking full metal content at New York price, minus 25% United States import tax, treatment charges and freight to New York.

Zinc—The tax will be 3% ad valorem, the value to be determined by taking 75% of the metal content at the St. Louis quotation for Prime Western spelter minus 10% United States import tax, and freight and treatment charges in the United States.

Some changes are noted in the telegraphic report of the new schedule which does not mention the exemption of the U. S. import duties in the valuation of lead and zinc ores, and with respect to zinc ores states that the value will be calculated on 75% of the assay result based on the New York price, deducting freight and treatment costs, taking as the average freight charge the rate between Saltillo, Mexico, and Tulsa, Okla.; value of other metals may be calculated on price at port of export.

Exemptions from taxes, it is further stated in the dispatch, will apply in the following cases: Copper ore containing less than 5%; lead ore with less than 15%; zinc ore with less than 20%.

Do Not Scrap the Printing Press*

When the people of the country, who are served by an intelligent and enterprising press, understand the full significance and effect of the Randall amendment to the post office appropriation bill, which provides that "all newspapers, magazines and other publications regularly admitted to the mails as matter of the second class" shall in future be classified very much like hardware, drygoods and general produce—that is to say, shall pay zone rates for transportation—the amendment, or rider, should have short shrift on the floor of Congress.

It is proposed that such publications pay 1c. per lb. for distances up to 300 mi., 2c. up to 600 mi., 3c. up to 1,000 mi., 4c. up to 1,400 mi., 5c. up to 1,800 mi., and 6c. per lb. for more than 1,800 mi. This indefensible and heavy tax would be a check upon the dissemination of news, useful information, literature and the discussion of public affairs in print; in effect an embargo upon enterprise, for there is many a newspaper and magazine, already crippled by the high cost of paper and of other materials, that could not stand the additional burden and would have to curtail the service it now renders to readers distributed from the Atlantic to the Pacific. Some minor but valuable publications would no doubt have to stop their presses altogether.

It is a prospect not to be endured by the American people, who have always prided themselves upon their excellent newspapers and magazines and the facilities provided by the Government for the circulation of them in the mails. The present flat rate is based upon a principle that the diffusion of printed intelligence is a duty of the Government, performed for the general welfare. Possibly the post office may not always or everywhere make money out of the transportation of newspapers and periodicals, but that is really of minor importance; for the product of the printing press in indispensable to good government. Better that the books shall show no profit than that the printing press shall be scrapped.

(Associated Press Dispatch)

Washington, Dec. 15—The $327,000,000 postal appropriation bill, as agreed on today by the House Committee, retains Postmaster-General Burleson's recommendations for curtailing pneumatic tube service and also retains a provision establishing zones for second-class mail matter, designed to raise the postage rates on periodicals. The bill will be reported immediately.

*From the New York "Sun" of Dec. 14, 1916.

American Cyanamid Co.

Negotiations have been concluded whereby the American Cyanamid Co. secures the extensive phosphate-rock mines of the Amalgamated Phosphate Co., in Florida, in exchange for its stock, says the *Boston News Bureau*, Dec. 14, 1916. One of the principal owners of the Amalgamated Phosphate Co. was the Virginia-Carolina Chemical Co., and it is understood the transaction has made the latter one of the largest holders of American Cyanamid stock. James B. Duke has recently acquired a considerable amount of the stock of the American Cyanamid Co. and with the Virginia-Carolina Chemical Co. and Sperlung & Co. of London represents a controlling interest. The balance is closely held.

The company's principal business is in supplying fertilizer companies, although an extensive trade is done with powder manufacturers, mining companies and other industries using nitrates, nitric acid, ammonia, etc. Along with other processes, the United States Government is considering the cyanamide process in connection with the establishment of its $20,000,000 nitrate plant. This process is in general use in European countries, but the American Cyanamid Co. controls American patents.

The Niagara Falls plant of the American Cyanamid Co. in 1910 had an annual capacity of 10,000 tons. In the last six years its capacity has been increased to 64,000 tons per annum. A factory is now being completed at Warners, N. J., for the manufacture of a new fertilizer material consisting of ammonia and phosphoric acid. The acid will be secured from the company's phosphate mine in Florida and ammonia from cyanamide produced at the plant at Niagara Falls.

The outstanding capital is $7,895,200 of 6% cumulative preferred and $6,514,000 common. Dividends at the rate of 6% annually are being paid on the preferred. All back dividends were paid off in December of this year. Earnings for the year ended June 30, 1916, were equivalent to $7 a share on the then outstanding common stock, all charges paid, including preferred dividends.

Editorials

Protest Against the Postal Bill

The Randall rider in the postal appropriation bill proposes to charge second-class mail matter according to the distance it is carried. This would be a fair and reasonable proposition if the post-office department were a commercial enterprise, like an express company; and if second-class mail matter were merely a commodity. But neither are such. The post-office department is supposed to be run for the benefit of the people. Magazines are not like goods that are eaten or worn out. They are for the dissemination of knowledge, i.e., most of them are, and they create business for many enterprises and for the post-office department. Anything that tends to curtail the circulation of a good magazine, or increase the cost of it to the public, is contrary to the interest of the people. The Randall rider is contrary to the interest of the people.

Consider what it will do, if enacted. Take the case of the *Engineering and Mining Journal*. A subscriber gets 52 issues in the year, the aggregate weight of which is about 40 lb. The bulk of our circulation goes long distances. A very large part of it—40% of the domestic circulation—goes 1,800 miles or more. On this the postage by the Randall schedule would be upward of $2.40 per subscriber per annum against $0.40 at present. The total increase in our postage bill would be more than the publication could stand, even disregarding the enormous increase in the cost of paper that we, like all publishers, have experienced. There could be but one way out of the predicament, and that would be to raise the subscription price. This is therefore a matter that concerns every one of our subscribers. What Mr. Randall proposes is far beyond what any publication with anything more than a local circulation can absorb. The increased expense would necessarily have to be passed on.

What we have said of the *Journal* applies in more or less degree to every other magazine. Most persons who take a paper like the *Journal* take others. The increased cost of subscriptions would in the aggregate amount to a sum worth thinking about seriously. Therefore the fight against this proposed legislation is your fight, Subscriber, as much as it is ours. Write at once to your representatives in Congress urging excision of the Randall rider from the postal appropriation bill. If they reply that the post-office department needs more money, tell them that it would not need it if it would run its affairs on real business principles. But, anyway, spare no effort to help kill the Randall rider.

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The Flotation-Process Decision

Although we printed the full text of the decision of the Supreme court—unofficial version—in our issue of last week, it reached us too late for comment upon it from the technical standpoint. As we read it at leisure, it impresses us as a perfect confirmation of Judge Bradford's opinion in the Miami case and an absolute upholding of the Sulman, Picard & Ballot basic patent, covering what we know as the froth-flotation process. The United States Supreme Court is emphatic in the opinion that the use of a certain very small quantity of oil produced an entirely different result from any other process, a result that was distinctly an invention, and an invention that had not been anticipated by anybody. The rapid and extensive adoption of this process, without advertising or promotion, impressed the court as a persuasive argument in support of that view.

The Sulman, Picard & Ballot patent comprises specific claims for the use of less than 1% of oil. These claims are sustained, and anybody who uses less than 1% of oil under the conditions set forth in the patent is an infringer. If anybody wants to use more than 1% of oil—even 1.01%—he is free to do so. We have heard the suggestion that some people will prefer to increase the percentage of oil used to the payment of royalty. But will they get the same metallurgical result? Not so, according to the evidence submitted to the courts. The drawing of the line at 1% seems arbitrary. It is arbitrary, for the patent claims had to be specific. The courts refused support of the claims that spoke only of a small quantity of oil and therefore were not specific.

Inasmuch as the United States Supreme Court and the British House of Lords have agreed in upholding the basic patent, the English-speaking world must bow to their judgment. The situation has not been cleared entirely, for there are matters in the Miami case that involve other patents that do not fall within the scope of the decision of the Supreme Court. But that the basic patent owned by Minerals Separation, Ltd., upon which the froth-flotation process rests, is valid there is no longer any doubt.

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"Wildcats"

At such times as the present and under the conditions that have prevailed during a few months past, when earnings are causing standard shares, shares of intrinsic value, to appreciate rapidly on the exchange, when the public awakens to what is going on and, coming into the market with a liberal amount of money, assists the professional operator—when these conditions prevail the "wildcat" finds its opportunity.

There are "wildcats" and "wildcats," but the "wildcat" to which we refer is the illegitimate offspring of a dishonest or ignorant promoter. Many of our readers will not be interested in our words of caution in respect to this breed of pest, and we deeply regret that we are unable to reach those poor fools who, yielding to the dulcet strains of the siren promoter, fall as his victims and then eternally damn the mining game. Nevertheless, we venture to inflict upon our readers some of our thoughts and observations, with the hope that they, in turn, may take up the work for honest mining and warn some of those who are less able to select the chaff from the wheat.

As one glances over the advertisements in the daily press of today, he will notice numerous announcements of

new or recent issues of mining stock. The experienced mining investor may not even see these, but they are read by hundreds of persons of small means who want to know a little more and who write to the broker or vender of the stock for the further information that he is glad to send "gratuitously." We have read with some interest and much disgust many sheets of this "gratuitous" literature during the last month, and we confess our inability to tag properly *all* the fakes and *all* the legitimate undertakings.

To one accustomed to reading mining literature, straight-forward statements of facts, as to conditions, yield or prospects, make a favorable impression, but a decidedly unfavorable impression is produced when one observes the extravagant use of adjectives, "beliefs," "expectations," "predictions," and "possibilities," with liberal reference to "the fortunes obtained from adjoining properties." While we say we cannot pick all the fakes, we believe that the literature purporting to describe them will, on its face, nine times out of ten stamp the wildcat with its proper brand, as it will also mark the legitimate type of mining venture.

There are innumerable prospects—thousands of them—well worth spending small sums upon to learn if they contain orebodies of importance. The seasoned operator rather fights shy of these prospects, the percentage of winnings is so small. Yet we want new mines, and mines are only made from prospects; we need the money of the public for this development work, and therefore far be it from our thoughts to discourage the small investor from taking any chances in the mining game. As it should be conducted, there is no more legitimate speculative business than that of mining, so rather than discourage, our aim is to stimulate and encourage the opening of good prospects; but we want the small investor, as well as the larger, to be fully informed of the risks that he takes, to to go in with his eyes open, and to get an honest return, if not a profitable one, for the risk he has taken.

What we object to is that type of literature which induces the uninitiated to come in with the understanding that he is practically sure of a rise in the market value of his stocks, and it is the half-truths that are worse than lies. Lies can be dealt with, deceptions cannot always be. We read such paragraphs as: "There is every reason to believe that these shares will double in value within the next few weeks;" "There are indications of probable ore to the extent of 50,000,000 tons;" "This adjoins the A—— property, is a continuation of the same deposit, A—— shares sold at $4 when they were brought out, now they are above $40.00." These and hundreds of other catchy phrases are not lies, but they are issued for the purpose of securing, and do secure, money under misunderstanding if not misrepresentations.

While we are suffering from lack of money to open numerous prospects, we are not suffering to the extent that makes misrepresentation necessary. An accurate statement of fact should be sufficient, and we venture to advise those who go to the public for their subscriptions that if they would stick to facts, their clients would be apt to stick to them. This is not a theoretical suggestion. Many responsible houses are following it, with the result that they hold their clientele regardless of occasional losses; it is satisfied with what it gets and it grows continuously without a campaign of flamboyant advertising. A prospect that is worthy of expenditures needs no adjectives to glorify it. Conditions plainly set forth in plain English by an engineer who understands his business should bring the desired funds. Of course, the public has been fed with claptrap so long that it might rather miss it for a while, and a certain type of broker would find little business if his circulars dealt only with facts.

To those who may be interested in following the market or investing in mining shares in a small way, we can only say, "Be careful." You can get reliable information respecting almost any mine promotion or the condition of operating properties from reliable engineers or reliable brokerage houses, and it will cost you little or nothing in comparison with the amount you stake when you take a "flier" without informing yourself of its merits.

Before us lie two circulars. One paragraph of the first reads: "The company's engineer states that in six months the actual and probable ore has grown from $280,000 to $3,112,000, and there is no reason why the next six months should not *do as well.*" The engineer's report also lies before us, and in it we read in reference to the work of the future: "There is reason to anticipate that the next six months will also *do well* in this respect, but new ground will be entered more slowly and no such rapid increase is likely. The chief changes will be from probable ore to proved ore." This is a fair sample of the poetic license that has been used to put a stock-market value of over $8,000,000 upon a property which, among its chief assets, has less than $700,000 gross of proved ore.

So far as we know, this particular property was started as a perfectly legitimate enterprise; it has added to its resources, it has employed responsible engineers and conducted considerable development work; but if its officers are cognizant of the methods used in advertising its shares, they are equally culpable with the brokers who are doing that which is not of advantage in the mining business. Is it not a shame to thus convert a legitimate prospecting enterprise into something almost approaching the illegitimate?

Another sheet lies before us wherein the reader is told of fortunes now being made out of copper mines—such fortunes as were never dreamed of—and that these fortunes came through investments in undeveloped properties such as it now advertises. The investor is told that he should select for speculation properties that adjoin big producers, especially those that are advertised, as they not only have all the same surface indications, but there are reasons to believe that the ore will be of higher grade than that produced by their operating neighbors. These shares, we are informed, that are now quoted at $1, have "possibilities of $20." We make note of this advertisement because the properties are in a well-known district where the geology has been carefully studied and regarding which the brokers have the best means in the world of securing information. Copper, like other metals, is where you find it, and there is no proof that it will not be found in commercial quantities here, though substantial operators have examined it and declined to risk its development; time and again well-informed geologists have pointed out the discouraging features and the slim chance the owners have of making other big mines in this particular area.

We do not mean to knock the district—we hope something will be found in addition to the wonderful deposits already developed—but we do wish to point out to the broker and to his client that the former is not giving

all the obtainable data to the latter and is not giving him a fair run for his money. He is bidding for his patronage by leading him to play the mining game on the curb, when he should be taught to play it only in the field, where nature, not man, will make or break him.

The Metric System Again

Mr. Dillon introduced in the House of Representatives, Dec. 6, a bill (H. R. 151) to make the metric system of weights and measures compulsory in the United States. This bill at least has the merit of explicitness. It does not attempt to sneak in a revolutionary change by language of hidden meaning. It provides:

Sec. 1. That the weights and measures of the metric system shall be the sole standard of weights and measures in the United States on and after July 1, 1920: Provided, that in the meantime such metric system shall be permissive.

Sec. 4. That any person, corporation, company, society or association who shall use or offer and attempt to use, in any industrial or commercial transaction in the sale or purchase of any commodity, any other weights and measures than those of the metric system on and after July 1, 1924, shall be guilty of a misdemeanor, and upon conviction thereof in any court of competent jurisdiction, shall be punished by a fine of not more than $500 or by imprisonment for not more than three months, or by both such fine and imprisonment.

The most interesting thing about this bill is the recklessness with which it proposes a change that would be nothing less than calamitous to the industries of the United States.

Belgian Kiddies, Ltd.

The subscriptions to this promotion are coming in satisfactorily, so its sponsors inform us, but the sum total is still short of what is needed. This is a flotation that mining engineers have undertaken in the interest of humanity and to support their colleague—Herbert C. Hoover—who has reflected great credit upon their profession.

The par value of the stock is $12 per share, but this does not mean that subscriptions are limited to one share. Let everybody subscribe for as much as he can afford and make out checks to Herbert C. Hoover, and address them to him at room 2124, No. 120 Broadway, New York. If you have not got a subscription blank handy, do not let the lack of it stop you. Just write a letter and inclose your check with it. The subscription books will not close on Christmas, but will remain open as long as the committee finds it necessary in order to make good.

After four years of "watchful waiting," an important mining-investment company of London has decided to cut in half the capital of the corporation on account of the depreciation of its mining investments in Mexico. At an extraordinary general meeting held in London on Nov. 15, a resolution was adopted by the Exploration Co., Ltd., to the effect "that the capital of the company be reduced from £750,000, divided into 750,000 shares of £1 each, to £375,000 divided into 750,000 shares of 10s. each, and that such reduction be effected by writing off paid-up capital to the extent of 10s. per share." Though the Exploration Co. has other mining investments, its principal interests are in Mexico, where its officials directed the operation of three important properties. Like many British, American, German and other foreign investors in Mexico, they have been compelled to see their properties damaged, idle, deteriorating, plundered first by one side and then by the other. One year passes and then another, and yet today the Mexican situation is as muddled as ever.

The two admirable pages, "Kinks for the Mine Shop," a novelty in this issue, are made up of sundry handy kinks from the pages of our esteemed contemporary, the *American Machinist*. They are for the benefit of the master mechanic and mine-shop foreman, who are relied on to keep the wheels moving at the mine, no matter what happens, and generally succeed. Too little space is devoted to them in the technical press. We shall continue this department for their benefit.

BY THE WAY

One of our correspondents, who has lately been at Jerome, Ariz., writes us as follows: "There are two mines here, two prospective mines and many wildcats. There will surely be some dumping before long. Excitement is great, but it is all among promoters, stock speculators and locators who are unloading."

The arguments on the flotation patents before the United States Supreme Court were attended by some unusual and very interesting features. The respective advocates gave demonstrations of the process in the court. This was extraordinary. The Supreme Court does not hear evidence. It considers only the arguments of counsels. In this case, the respective counsels proposed to illustrate their arguments by some experiments. At first the court refused to entertain this novel idea, saying that there would be noise, which would be contrary to all precedents in the annals of the Supreme Court. Upon receiving assurances that there would be no noise, the court consented to witness the experiments in an informal session. Three hours were allowed for this, each side having half the time. The session being informal, the justices attended without wearing their gowns. They were just like "human beings," as one observer remarked. Of course, the experiments had been well planned in advance. Mr. Williams, counsel for Minerals Separation, started three experiments going. The interest of the justices had already become intense. One of them said: "You do not expect us to watch a three-ring circus, do you, Mr. Williams." "Oh, no," said Mr. Williams. "I am simply getting things ready so that results will develop in successive order, and you will have to look at only one at a time." He then exhibited the working of the Everson, Froment, Kirby and other processes. After he had concluded, Mr. Scott, for the defendant, made experimental demonstrations to illustrate his own argument. Altogether the Supreme Court gave about seven hours to the hearing of this case, the time devoted to an ordinary case being about three hours. The fact that the flotation case reached the Supreme Court on a writ of certiorari was in itself extraordinary, for patent cases are not ordinarily heard. The reason that an exception was made of the flotation case was its international character and the fact that the decision of the San Francisco court was in absolute conflict with that the British House of Lords.

New York Section Meeting of the A. I. M. E.

The regular monthly meeting and dinner of the New York Section of the American Institute of Mining Engineers was held at the Machinery Club, Dec. 14. Following the policy of the section in breaking away from strictly technical subjects and dealing with big broad problems of everyday vital interest, the subject for the evening was "Policing a Big City," and the speaker was Raymond B. Fosdick, who spent two years abroad for the Rockefeller Foundation, studying the police system of all the large foreign cities.

The subject did not draw a large attendance; this was unfortunate, because it proved to be an intensely interesting talk. The details of actual policing were not gone into, but in a broad, general way the policing of New York was compared with that of London, Berlin and Paris. Mr. Fosdick said that the policing systems of foreign cities are so far ahead of any of our own in efficiency that it is a waste of time to make comparisons. On the other hand, those same efficient systems, if transplanted to New York, would absolutely fall down on account of the difference in the problem here, largely because of the difference in the size of the foreign-born population. The foreign-born population of New York City is 44%, and adding to this the first generation makes about 66⅔% foreigners in New York City, whereas in the big cities of Europe only 1½ to 4% are foreign-born. This makes the foreign problem of policing much easier than our own. What makes for further greater efficiency abroad is the fact that a man is trained for the duty over there, and like the present head of Scotland Yard, who has been in office for 17 years, serves for uniformly long terms. In New York there have been 11 police commissioners in nine years, no one of them being in office long enough to find out what his job was all about. A policeman in Berlin before he receives his appointment has to have served nine years in the German army and reached at least the grade of *unterofficier,* which is equivalent to the grade of sergeant in our army. When he goes on duty, he is equipped with a very serviceable sword, an automatic pistol, a pair of handcuffs, a blackjack and a set of brass knuckles. His equipment and his previous training make him very brusque and his actions are quite intolerable to Americans who happen to cross his path. This was contrasted with the London Bobby, who is invariably chosen from outside of London so that he will have no acquaintances or connections in the big city. He is equipped solely with a small stick, which would break if he struck anyone with it. The speaker described the method of their handling the suffragettes in one of their attacks on a cordon of policemen, behind which Mr. Fosdick watched the following episode:

One of the belligerent women, armed with a beer bottle, struck one of the policemen a vicious blow on the head. The bobby picked up his helmet, brushed the dirt off, straightened out the dent and said very courteously, "Madam, if you do that again, I shall be obliged to place you in custody."

Thanks to the lower percentage of foreign population in the foreign countries, and much more efficient officers and the much more sensible system, crimes of violence of all classes, including murder, burglary, assault, etc., amount in foreign countries to only one-tenth the number which we have in this country in cities of similar size.

Mr. Fosdick's talk was enthusiastically received by the members present, and many questions were asked after the speaker had closed.

Direct Brass-Making

According to Mr. Pierron in French patent 479,599, Aug. 26, 1915, finely powdered low-grade oxidized zinc ore, etc., is heated, preferably in crucibles, with an excess of carbon and copper strips or turnings to 800-950° C. for 6 to 10 hr., whereby the zinc vapor is absorbed by the copper, without fusion of the product. The copper may thus be converted into brass containing 10 to 20% Zn in one operation. By repeating the operation three or four times, the zinc content may be raised to 40-45%, but to obtain any given exact composition, it is necessary to melt the brass so formed, and make suitable additions of copper or zinc.

This seems to be simply the ancient process of making brass by cementation. Query: Might the electric furnace be used successfully in a revival of this process?

Platinum in Russia

The British consul at Ekaterinburg, Russia, reports that during the current year the production of platinum in the Urals has been seriously affected by the scarcity of labor in the case of hand washings by tributers, and in the case of mechanical dredging plants by the difficulty of obtaining spare parts for dredges. The production of platinum in 1916 is estimated at 100 to 120 poods (3,600 to 4,300 lb.), or one-third of the normal. To this decrease in output, as well as to speculation by local buyers, may be attributed the rise in the price of platinum.

Union Sulphur to Refine Oil

Vice-Pres. Henning, of the Union Sulphur Co., of Sulphur, La., and associates have purchased, according to *Boston News Bureau,* Dec. 14, 1916, 2,000 acres along the ship channel, three miles south of Port Neches, for a large oil refinery. Extensive railroad and deep-water shipping terminals will be built, and the refinery will be one of the largest in the United States. It will be connected with the oil fields of Louisiana and the Gulf Coast territory of Texas by a system of pipe lines.

Mechanical Analyzer for Carbon Dioxide

In the description of the carbon-dioxide analyzer made by the Bacharach Industrial Instrument Co., in the *Journal* of Dec. 9, p. 1022, the statement of the limit of accuracy is in error. Instead of being accurate within 2%, the instrument is accurate within 0.2%.

Imports of Metals Into Russia from the United States half-year ended June 30 were valued as below in rubles:

	1915 Rubles	1916 Rubles	Changes
Copper	312,000	10,458,000	I. 10,146,000
Lead	207,000	3,197,000	I. 2,990,000
Zinc	115,000	3,458,000	I. 3,343,000
Nickel	191,000	2,040,000	I. 1,849,000
Iron and steel	124,000	16,276,000	I. 16,152,000
Machinery	1,550,000	8,011,000	I. 6,461,000

These figures show direct shipments from United States. Goods transshipped are credited to the country of transshipment.

Personals

Dr. James Douglas, of New York, has made a gift of $15,000 to McGill University, Montreal.

James M. Hyde has removed from Silverton, Colo., to 260 Churchill Ave., Palo Alto, Calif.

W. D. Anderson has been elected president of the Buckeye Iron and Brass Works Co., Dayton, Ohio.

Robert E. Cranston left San Francisco on Dec. 10 for Colorado and New York, on professional business.

Louis D. Huntoon left New York on Dec. 16 for a professional visit to the Black Range district of New Mexico.

H. A. Keller, who is spending considerable time in Cuba, has opened a branch office at San Ignacio 25, Havana.

W. J. Elmendorf is now associated with the firm of Campbell, Wells & Elmenderf, engineers, metallurgists and chemists, at Seattle, Wash.

Meyer Davis, formerly chief engineer for the Asbestos Protected Metal Co., has been made manager of the company's San Francisco office.

Sir Sam Hughes, formerly Canadian minister of militia, visited Bourkes in Northern Ontario, where he has considerable mining interests, on the 13th inst.

Prof. Stephen Leacock, of McGill University, has proposed to the Canadian government the calling in of all silver currency and the substitution of a nickel coinage.

W. C. Stevens has been appointed mill manager of the Cutler-Hammer Manufacturing Co., of Milwaukee. He has been connected with the Cutler-Hammer Co. about ten years.

Edward P. Scallon has been promoted from the position of mining captain of the Lincoln mine, of the Inter-state Iron Co., Virginia, Minn., to the superintendency of this property.

William Sloan, member for Nanaimo, has been chosen as minister of mines for British Columbia, in the Brewster government, which came into power as a result of the provincial election held in September last.

John M. Turnbull, professor of mining in the British Columbia university has returned to Vancouver from Alice Arm of Portland Canal, which he visited to make examinations for the provincial department of mines.

Albert E. Wells, professor of machine construction, Sibley College, Cornell University, will delivered the last lecture in the courses recently inaugurated for the employees of the Shepard Electric Crane and Hoist Co., Montour Falls, N. Y. The lecture was given on Dec. 21 and was on "Measuring Instruments and Systems."

A. L. Tuttle has been appointed acting manager of the Tennessee Copper Co. at Copperhill, Tenn., and A. M. Fairlie has been made superintendent of the acid plant. Milton A. Caine has resumed the position of superintendent of mines, and Thomas W. Cavers remains as smelter superintendent, and William F. Nolan as chief engineer.

Edwin Walter Mills and **John Francis Manning,** recently superintendent and mining engineer respectively, of the Seoul Mining Co., Chosen, who have been in this country visiting for six months, have left for the Pacific Coast and will sail for the Orient Jan. 27. After visiting Chosen, they will go to Peking, where they will open offices as consulting engineers. Their address for the present is care of American Legation, Peking, China.

H. M. Wolfin has been designated by the U. S. Bureau of Mines to succeed Edwin Higgins, in charge of the California coöperative work of the bureau and the Industrial Accident Commission. Mr. Wolfin had charge of this work from January, 1914, to January, 1916, during which time he made a preliminary survey of mine safety conditions in the state and assisted in drafting the mine safety rules. The Industrial Accident Commission has appointed Mr. Wolfin chief mine inspector.

W. W. Johnson, president of the Union Construction Co., of San Francisco, who recently returned from Alaska dredging fields, besides looking after the operation of company dredges, also visited districts in which the company is constructing dredges for other operators, including Dawson, Yukon River, Tananna, Fairbanks, Iditarod, Black Creek, Otter Creek, Flat Creek, Kuskokwin River, Rock Creek and Buck Creek. Placer mining in these districts is not all done by bucket-elevator dredges; steam shovels and draglines are also employed.

A. H. Colbran, general manager of the Seoul Mining Co., has resigned the active management of its Korean properties, and will devote his time to personal and growing mining interests in the Orient and the United States. The company, however, is fortunate in retaining Mr. Colbran's services as a director, in which position the company will benefit by his extensive knowledge of the mines which were developed during the past eight years under his organization and management from mere prospects into one of the best paying properties in the Far East. The profits previous to 1916 were derived almost entirely from the company's principal mine, the Suan, which was developed and equipped under the management of Mr. Colbran. During the current year another mine, the Tul Mi Chung, has come into production, and the profits from the properties for 1916 will exceed $1,200,000. The principal product is gold with copper, bismuth and tungstic acid as byproducts.

Obituary

Rembler Paul, of Kelowna, died at Edmonton Nov. 18, at the age of 85. He was for many years interested in Bankhead coal mines and at the time of his death was the principal owner of the St. Paul gold mine near Vernon.

Frederick Holly Reed, vice-president of J. G. White Co., incorporated, contracting engineers, 43 Exchange Place, New York, died suddenly Dec. 9 from heart disease in his home in New York City, aged 51 years. He was a civil engineer and had been active in railroad development in the Philippines. He was vice-president of the Manila Electric Railroad and Light Co.

Societies

Engineers Society of Western Pennsylvania held a meeting on Dec. 19, at the society's rooms at Pittsburgh. A paper on "Engineering Coöperation and Fellowship" was read by D. Robert Yarnall, of the Nelson Valve Co.

American Institute of Mining Engineers, Utah Section, held its postponed annual meeting at the Hotel Utah, Salt Lake City, on Saturday, Dec. 16. The members assembled at dinner after which officers were elected, and papers on "Notes on Flotation in 1916," by J. M. Callow, and "Manufacture and Use of Sulphuric Acid," by Erwin Wilke, were read. The meeting was well attended and proved interesting to all the members.

Trade Catalogs

Wico Safety Electric Mine Lamp. Witherbee Igniter Co., Springfield, Mass. Catalog. Pp. 12; 5½x9 in.; illustrated.

The Lindsay Oil Furnaces and Burners. The Mine and Smelter Supply Co., Denver, Colo. Bulletin No. 34. Pp. 24; 7x10 in.; illustrated.

Dry-Air Ore Concentrator. National Engineering and Manufacturing Co., Massillon, Ohio. Bulletin No. 100. Pp. 6; 66x9 in.; illustrated.

Imperial Oxy-Acetylene Welding and Cutting Apparatus. The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. Catalog No. 135. Pp. 28; 7x10 in.; illustrated.

Pine Flotation Oils. Pensacola Tar and Turpentine Co., Gull Point, Fla. Pamphlet. Pp. 8; 8x10½ in. This describes how these oils are produced and contains line drawings of distillation plant.

Industrial News

Terry Steam Turbine Co. has located an agency at San Francisco, Stephenson & Nichols, Monadnock Building, taking the representation.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Amalgamation—Amalgam Mixer. Horace E. Basehore and Edward L. Kraft, York, Penn. (U. S. No. 1,207,703; Dec. 12, 1916.)

Belting—Method of Splicing Belting Material. Ernest L. Burrell, Chicago, Ill. (U. S. No. 1,207,853; Dec. 12, 1916.)

Coke Ovens—Method of Heating Coke Ovens and the Like. Rudolf Geipert, Berlin, Germany, assignor to Dessauer Vertikal Ofen Gesellschaft, Berlin, Germany. (U. S. No. 1,208,134; Dec. 12, 1916.)

Concentrator—Ore Concentrator. Hannibal Scovell, Galena, and Leslie E. Scovell, Columbus, Kan. (U. S. No. 1,207,803; Dec. 12, 1916.)

Crucibles—Composition of Matter to Be Used for Preserving Graphite Crucibles. James B. Carmichael, Seattle, Wash., assignor of one-half to Hine J. Harper, Seattle, Wash. (U. S. No. 1,207,858; Dec. 12, 1916.)

Dipper Bucket. Ellison Edward Vanderhoef, Ruth, Nev., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,208,055; Dec. 12, 1916.)

Fuel—Method of Carbonizing Fuel. Henry L. Doherty, New York, N. Y. (U. S. No. 1,207,723; Dec. 12, 1916.)

Furnace—Furnace and Allied Structures, Utley Wedge, Ardmore, Penn. (U. S. Nos. 1,208,246; 1,208,247; 1,208,248; 1,208,249; 1,208,250; Dec. 12 1916.)

Furnace Equipment—Rabble-Arm Mounting for Metallurgical Furnaces. Utley Wedge, Ardmore, Penn. (U. S. No. 1,206,961; Dec. 5, 1916.)

Furnace for Galvanizing Wire. Guy L. Meaker, Joliet, Ill. (U. S. No. 1,208,185; Dec. 12, 1916.)

Gold—Process of Recovering Gold. James H. Alling, Columbia, Calif., assignor of one-half to Francis M. Wright, San Francisco, Calif. (U. S. No. 1,207,261; Dec. 5, 1916.)

Ingot Mold. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,207,645; Dec. 5, 1916.)

Ingot Mold. George A. Dornin, Baltimore, Md. (U. S. No. 1,208,519; Dec. 12, 1916.)

Ingot Mold—Feeder for Standard Ingot Molds. Ernest J. Turner, Pittsburgh, and Bloomfield H. Howard, Aspinwall, Penn. (U. S. No. 1,208,703; Dec. 12, 1916.)

Ingot-Mold Top. Edward F. Kenney, Westmont Borough, Penn. (U. S. No. 1,207,054; Dec. 5, 1916.)

Metals—Process of Carbonizing and Hardening Metal. Nelson H. Bray, San Francisco, Calif. (U. S. No. 1,207,848; Dec. 12, 1916.)

Metallic Deposition—Process of Producing Metallic Deposits. François Auguste Roux, Paris, France, assignor to Société l'Aluminium Français, Paris, France. (U. S. No. 1,207,218; Dec. 5, 1916.)

Mill Liner. Frank E. Johnson, Salt Lake City, Utah, assignor to American Manganese Steel Co., Augusta, Me. (U. S. Nos. 1,207,173, 1,207,174; Dec. 5, 1916.)

Mine-Car Coupling. David J. Williams, Herrin, Ill., assignor of one-third to George H. Williams, Herrin, Ill. (U. S. No. 1,207,114; Dec. 5, 1916.)

Mining and Surface Support. Arthur Langerfeld, Scranton, Penn. (U. S. No. 1,207,569; Dec. 5, 1916.)

Nitrogen—Manufacture of Oxides of Nitrogen. Carl Bosch, Alwin Mittasch and Christoph Beck, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin and Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. (U. S. Nos. 1,207,206; 1,207,207; 1,207,208; Dec. 12, 1916.)

Smelting—Process of Smelting Metallic Ores. Henry L. Dogherty, New York, N. Y. (U. S. No. 1,207,881; Dec. 12, 1916.)

Titanic Oxide—Method of obtaining Titanic Oxide. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. Nos. 1,206,796; 1,206,797; 1,206,798; Dec. 5, 1916.)

Tungsten—Process of Treating Ferro-Tungsten. Philip M. McKenna, Washington, D. C. (U. S. No. 1,208,596; Dec. 12, 1916.)

Tunneling—Method of Tunneling. Edward E. McCabe, Benton, Wis. (U. S. No. 1,208,178; Dec. 12, 1916.)

Zinc—Process of Extracting Metals from Their Ores. Sidney E. Bretherton and Frank L. Wilson, Berkeley, Calif. (U. S. No. 1,204,843; Nov. 14, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida.	Dec. 9	Jan. 9	$0.001
Beaver Copper, Utah.	Dec. 11	Dec. 30	0.005
Bullion, Nev.	Jan. 8	Jan. 30	0.02
Caledonia, Nev.	Jan. 9	Feb. 3	0.05
Carbonate Keystone, Utah.	Dec. 14	Jan. 2	0.01
Century Gold, Utah.	Dec. 10	Jan. 10	0.01
Challenge, Nev.	Nov. 29	Dec. 20	0.05
Christmas, Utah.	Nov. 20	Dec. 16	0.005
Con. Virginia, Nev.	Dec. 8	Dec 29	0.05
Eagle Mtn., Ida.	Dec. 22		0.001
East Hercules Ext., Ida.	Jan. 2	Feb. 2	0.0005
Ely-Gibraltar, Nev.	Dec. 15	Jan. 10	0.0025
Emerald, Utah.	Dec. 15	Jan. 13	0.001
Eureka, Ida.	Dec. 9	Jan. 9	0.001
Exchequer, Nev.	Dec. 5	Dec. 27	0.03
Federal Ely, Nev.	Dec. 2	Dec. 20	0.005
Four Timbers, Ida.	Dec. 2	Jan. 2	0.002
Hector, Ida.	Dec. 22	Jan. 16	0.005
Idaho-Nevada, Idaho.	Nov. 15	Dec. 16	0.002
Idora, Ida.	Nov. 24	Dec. 23	0.005
Imlay, Nev.	Dec. 19	Jan. 9	0.01
Iron King, Ida.	Dec. 9	Jan. 9	0.001
Mayflower, Ida.	Dec. 23	Jan. 25	0.005
Mexican G. & S., Nev.	Nov. 25	Dec. 18	0.10
National Lead, Ida.	Nov. 25	Dec. 26	0.001
Nevada Zinc, Nev.	Nov. 26	Dec. 16	0.01
New Hope, Ida.	Dec. 11	Jan. 11	0.002
North Franklin, Ida.	Dec. 30	Jan. 22	0.005
O.K. Extension, Utah.	Dec. 21	Jan. 10	0.0025
Old Veteran, Ida.	Jan. 6	Jan. 27	0.002
Ophir, Nev.	Jan. 9	Jan. 30	0.05
Paloma, Utah.	Dec. 12	Dec. 28	0.015
Potosi, Nev.	Jan. 8	Jan. 31	0.02
Rarus M. & S., Utah.	Dec. 16	Jan. 4	0.00075
Reindeer Queen, Ida.	Dec. 16	Jan. 22	0.005
Savage, Nev.	Jan. 5	Jan. 29	0.02
Sierra Nevada, Nev.	Jan. 4	Jan. 25	0.10
Silver Moon, Ida.	Nov. 25	Dec. 23	0.005
Silver Pick, Nev.	Dec. 2	Jan. 8	0.02
Slavonian, Ida.	Dec. 30	Jan. 20	0.001
Tarbox, Mont.	Dec. 22	Jan. 13	0.005
Tiberius, Ida.	Dec. 21	Jan. 12	0.00075
Wallace M., M. & R., Ida.	Dec. 8	Jan. 8	0.0025

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Dec. 13

New Oil Wells starting to drill in the 11 months of 1916 have reached a total of 677. For the week ended Dec. 2, 14 new wells started drilling and in the preceding week 13 new wells were ready to In each of these weeks, six wells were ready to be deepened or redrilled and in the two weeks, 22 wells reported ready for test of water shutoff. Since the first of the year, there have been about 825 inspections of wells for infiltration of water. The shutting off and plugging of these wells will occupy a great deal of the time of the oil and gas department of the State Mining Bureau in the coming year.

The Advance in Dredge Construction and operation in California in 1915 and 1916 invites attention to the possibility, if not probability, of a revival of legislation antagonistic to the dredging industry. The danger is by no means an imaginary one. The "friends of the farmers" are as alive if not as active today as they were 33 years ago when they put hydraulic mining in the discard, reducing the industry to an insignificant position. Gold dredging, in spite of various and sundry predictions of prospective rapid decline, produced in 1915 a total of $7,796,465 with 58 dredges. In 1916 three large all-steel dredges have been put in commission and another is in construction. Others will follow in 1917 and in the same year the legislature will again be in session. And the same element in the political fabric of the state that put the ban on the hydraulic mines in 1883 waked up again in 1913 with the purpose of depriving dredge miners of the right of recovery of gold by dredging. Not because the method interfered with farming, but to conserve lands chiefly nonarable for the future. The meddlesome spirit of 1883 and 1913 which sought the protection of the farmer at the expense of the miner without compensation is not dead nor even sleeping. The head of it bobbed up in the legislature of 1915, but the administration had too many other irons in the fire to permit a revival then of the attack upon the dredging interests. The legislature of 1917 may not be so easily controlled as was the case during the administration of Governor Johnson, the only man in the history of the state who successfully occupied the dual position of governor and boss of the administration. Had Governor Johnson permitted the renewal of the attack upon dredge miners in 1915 there would have been a different story to tell at the end of 1916 from that which may be told of the increased acreage prospected for dredging and the advancement in dredge construction. Possibly he foresaw the folly, from a political point of view, of flying in the face of a great industry, or realized the immense damage to the state that must inevitably follow the prohibition of gold dredging.

Plymouth Consolidated on the Mother Lode, in Amador County, has produced in 27 months of active mining since reopening, nearly $1,500,000. The total net profit from operation during that period amounted to $460,000. When the mill started operation July 29, 1914, the ore in reserve amounted to 110,000 tons. The total production of ore has amounted to 270,000 tons and in November there were 180,000 tons in reserve. The mine was recently equipped with an electric hoist capable of lifting from a depth of 5,000 ft. Shaft is now 2,450 ft. deep and preparations are being made to sink 300 ft. deeper. The mine is controlled by Bewick, Moreing & Co., of London. The property was developed and put upon a paying basis by William J. Loring and Albert Burch, of San Francisco. William F. Parks is superintendent. Mr. Loring worked at this mine during his boyhood and when he became the active head of Bewick, Moreing & Co.'s American activities, this was one of the first California properties that he undertook to reöpen. Since then he has, without the aid of the English company, taken over other large properties on the Mother Lode, including the Dutch-Sweeney and App in Tuolumne County and a large group near the Melones, in Calaveras County, and has recently begun reopening the Hardenberg mine at Jackson. Prior to the war Bewick, Moreing & Co. had undertaken the reopening and development of the Nashville in Eldorado County. The other properties just mentioned were taken over by Mr. Loring after the war begun and at a time when no investment money could be obtained from England, on account of the war. The money secured for the purpose of development of these properties came from American investors. Mr. Loring is one of the increasing number of California mine operators who believe in and follow the policy of letting the public know what is being done at the mines. Plymouth Consolidated conforming to British custom, publishes monthly reports of production, and details of mine operation that can be properly made public about any of these reopened properties are given out without hesitancy. Greater freedom of publicity concerning the activity of the mines in California would assist materially in securing investors for the reopening of a number of properties in this state, which are valuable but which have been long idle for lack of general knowledge concerning their possibilities and the record of the districts in which they are situated.

BUTTE—Dec. 14

The Ophir Mill of the Butte-Detroit company will begin operations before the end of December. Zinc ore from the Davis-Daly is being hauled to the Ophir and there will be a good surplus on hand for the mill when it is ready to start. Flotation cells have been installed and the practice will be modern in every particular.

A Miners' Home may be established in Butte. The first bill to be introduced by Representative Ward, of Silver Bow County, in the legislative assembly that meets Jan. 1, will be one to provide for the establishment of a Miners' Home in Butte. While the details of the bill have not yet been perfected, it is understood that the home will be for old Butte miners, too old or incapacitated to continue in the industry of mining but still capable of making themselves useful in less arduous occupations. Mr. Ward is confident that a bill to that effect will be passed.

DENVER—Dec. 16

Important Legislation Questions will come before the Colorado Metal Mining Association at its fourth annual meeting in Denver, Jan. 3, 4 and 5, 1917. Among the questions to be considered are the following: Proposed repeal of the present law for the taxation of producing mines; proposed change in laws regarding the Industrial Board and Compensation Insurance; action of the association regarding the regulation of smelters by the Public Utilities Commission; proposed tariff laws affecting tungsten and other metals mined in this state; coöperation of the association with similar organizations in otner states for mutual benefit; proposed changes in the Federal mining laws; Government conservation policies and continued withdrawal of public lands from development. Each metalliferous mining county of the state will send delegates to the meeting. County conventions are now being held for the purpose of electing these delegates.

The Prospectors Course at the Colorado School of Mines will be condensed from five into four weeks, this winter. The "Short Course for Prospectors," inaugurated in January, 1915, proved so profitable and popular that in 1916 the course was extended. As a result of the success that attended this innovation, it has become an established part of the work of the School of Mines and will be offered annually as long as there is any apparent need or demand. The third annual short course for prospectors will be given at Golden during the four weeks beginning Feb. 5 and ending Mar. 3, 1917. It is planned to condense the work and keep the prospectors occupied throughout the day instead of in the morning only. This will be an advantage from the point of view of instruction and will make the course less expensive to those who attend. All of the courses will be of the most practical nature and will comprise instruction in mineralogy; common minerals and rocks; elementary chemistry; principles of ore dressing; assaying; the more common metallurgical processes; methods of valuing, buying and selling ore; placer and lode mining; location of mining claims; and first aid to the injured. The courses will be given by regular members of the faculty and will consist of lectures and laboratory demonstrations.

SALT LAKE CITY—Dec. 15

Resource Maps of Four Counties of the state are being prepared by the Utah Conservation Commission, and will be included in a report to be issued the first of the year. The commission has received numerous inquiries in regard to deposits of clays suitable for paint manufacture, iron deposits and mineral resources generally.

New Mining Town in Tooele County, is rapidly growing up in the Clifton district in the Deep Creek section to meet the completion of the railroad which will open up this part of the state. Gold Hill, the terminus of the road, is to be called Goodwin in honor of Judge Goodwin, of Salt Lake, who long advocated the construction of such a road. A townsite company has been formed, and houses and store buildings are being built. There is a congestion of freight at Wendover, and freight rates between here and Goodwin have been raised. A good many mining claims in the district have changed hands. One group near Gold Hill said to have been taken over by Eastern men. Two shipments of high-grade tungsten ore were made recently by parcels post from Seminole Copper, owned by the Wilson brothers.

WALLACE, IDAHO—Dec. 15

The Evolution Mine, near Osburn, the first location made in the Coeur d'Alene district, is experiencing what its name suggests. After a lapse of almost 50 years, during which time efforts to place it on a productive and profit-earning basis proved unsuccessful, it now promises to serve a useful purpose and return some revenue to its owners by furnishing lime for the new Bunker Hill & Sullivan smelting operations. The Evolution vein is a large one and has been explored by a crosscut and drift; it carries about 37% CaO, besides more or less lead, zinc, gold, silver and copper. The Bunker Hill & Sullivan company has taken a lease on a block of ground 500 ft. along the vein, extending 800 ft. to the surface and will mine it for the lime, paying the Evolution owners 25% of all valuable metals recovered. The Evolution was located in 1878 by Andrew J. Prichard, who believed that he had discovered a gold mine. It was from his camp at Evolution that Prichard wandered north about 20 mi. and in 1883 discovered placer gold on the creek that bears his name, an event that caused a stampede the winter of that year and marked the beginning of mining in the Coeur d'Alene district.

Renewal of Gold-Mining Activity is in sight for next year in that section of the Coeur d'Alene district, commonly referred to as the North Side and including the drainage of Prichard and Trail Creeks, the scene of the early-day gold mining which preceded the development of the great lead deposits on the South Side. These prospective operations include both placer and quartz gold, with tungsten as an important side issue. For many years the Golden Chest, near Murray, has been worked intermittently and with indifferent success, liberal amounts of scheelite either being left in the mine or allowed to escape as waste in the tailings. During the last year, however, much attention has been given, through changes in the stamp mill, to the recovery of tungsten in the form of concentrates. These efforts have been partially successful, but meantime the price of tungsten dropped from its high estate to about $16 per unit, which has rendered necessary more perfect methods of separation and concentration than the plans contemplated. This situation, together with the approach of winter and the shortage of water for power, have combined to close the property until spring, when it is announced the owner of the Golden Chest, Vivian Green, a wealthy New Yorker, will build a new and modern mill, designed for the economical recovery of both the gold and tungsten. After many years of inactivity, the large tract of placer ground owned by the Coeur d'Alene Mining Co. was the scene of extensive prospecting during the summer. The holdings of this company include practically all the ground adjacent to Prichard Creek throughout its length, a distance of 13 mi. The company is composed of a group of Boston capitalists, but the report is current that the ground is now under option to the Guggenheims. The property was acquired by the Boston people many years ago and nothing whatever was done toward its development until last spring, when J. S. Wyatt, of California, appeared on the ground and proceeded to prospect it thoroughly. Two Keystone drills were used and for a period of four months about 30 men were employed night and day systematically sinking prospect holes to bedrock, covering a large section of the ground above and below Murray. While no authentic information can be obtained on the subject, the impression prevails that this prospecting work was done for the Guggenheim interests, that it proved in every respect satisfactory, and that dredging operations on Prichard Creek will be inaugurated during the coming year.

JOPLIN—Dec. 18

Increase of 15c. per Ft. for Drilling is threatened by drill contractors of this district. Two years ago 90c. per ft. was charged. Now it is $1.10, and drillers say they must get $1.25 per ft. to make as much as they were making two years ago. They declare the price of rope, casing and coal has gone up about 50% and labor and teams are also paid for at higher rates. The increase, if it goes into effect, is not likely to slow down prospecting much, as at present it is impossible to get drill rigs enough.

The Strongest Operators Association the Joplin district ever had, the Southwest Missouri Mine Safety and Sanitation Association, held its annual meeting last week and elected W. B. Shackleford, of Webb City, president, to succeed Charles T. Orr, who was made vice-president. William Rhea, of Carthage, was reëlected secretary and A. F. Carmean treasurer. Richard Jenkins, of Webb City, is the assistant secretary of the organiza-

tion. Mr. Orr doubtless would have been reëlected to head the organization but insisted his name be not considered, as his interests in the Athletic Smelting Co., which is erecting a plant at Fort Smith, Ark., would prevent his giving the association the necessary time. Mr. Shackleford is one of the veteran operators of the district. For a time he was at the head of the Jasper County Anti-Tuberculosis Society.

HOUGHTON, MICH.—Dec. 16

Labor Supply Easier now in the Lake copper country. During the earlier part of the year it was found necessary, by the mining companies, to import men into the district, but conditions at present are such that the companies near the larger towns have been obliged to turn away men, thus enabling the smaller and more remote mines to increase their forces. Some of the smaller mines in the outlying districts that were operating as best they could with short crews, will now be able to make a showing. With the bonuses lately announced, the mining companies in the copper country are now paying the highest wages ever offered in this district.

Shortage of Coal among the Lake copper mines for the present winter is now generally acknowledged. One fuel company, which has been accumulating screenings for nine years, hoping some day to be able to sell them for $2 a ton, recently disposed of the lot for $5 a ton to a large producer. The only large fuel-using interests in the Lake Superior country who have coal enough on hand to tide them over until midsummer of 1917 are the Stone & Webster people, who operate the electric-light plants and the street-railway system. Their fuel supply, sufficient to last until September of next year, was brought in early last summer. Mining companies bought their usual requirements, but they are using at least 20% more than ordinarily.

Quincy's Record Tonnage of 4,600 tons of copper rock was sent to the mill one day last week. The average now maintained is above 4,300 daily. This is a great tribute to the efficiency of the Quincy, from manager down to trammer, for the whole tonnage comes out of three shafts, all of them deep and one requiring a shaft haulage alone of 1½ mi., to say nothing of the tram haul. Further increase in tonnage may be anticipated from No. 2 shaft where a new hoisting engine, with a rope length of about 2 mi. will be installed within the next six months. The present hoist is being worked to its limitations. The working force at the Quincy has been increased recently and will be further added to in Januray.

Mass Consolidated has just finished unwatering the old Evergreen workings, the work having been done at small expense by an air lift and a drill hole. Miners will be put to work there this week and it will be opened wherever favorable showings are found. This may result in substantial additions to the company's production as the Evergreen was in good rock when last abandoned. Mass is today securing most of its copper rock from the Butler lode, but about half of its actual production comes from the newer Evergreen workings. The anomoly is explained by reason of the fact that of the total Mass production fully one-quarter is barrel and mass stuff that goes directly to the smeltery on flat cars; practically all of this comes from the newer Evergreen workings and in addition the lode furnishes a proportion of the stamp mill rock.

WASHINGTON, D. C.—Dec. 16

Glossary of Mining Terms is being compiled by the U. S. Bureau of Mines. In order to have the new glossary complete, 60 different glossaries have been studied and are being embodied in the new compilation. In addition, other sources of mining terms are being drawn upon. Expressions peculiar to mining in South Africa, in Wales, in New Zealand and in other parts of the United Kingdom will be embodied as well as those in use in the different mining regions in this hemisphere. The glossary, which will be published ultimately as a bulletin by the Bureau of Mines, will also include a lengthy list of Spanish mining terms.

Mining Experiment Station Plans are being formulated, with the return to Washington of Dr. F. G. Cottrell, chief metallurgist of the Bureau of Mines. At Seattle it is the intention to pay important attention to electro-chemical problems. Possibilities of the utilization of electric power in mining is also to be given a prominent place in the work of this station. It is expected that the Seattle station will be a sort of clearing house for Alaskan mining matters in addition to the work on the general problems of the Northwest. At Tucson the problems of handling low-grade ores profitably will be given first place. This will include studies of the flotation and leaching processes. A special effort is to be made at Tucson to aid the small operators. Another matter which is to be given careful attention is the study of methods of ore treatment which require a small amount of water. Dry concentration, electrical concentration and hydro-metallurgy, in general, will be made the subject of constant research. In the opinion of J. A. Davis, who is to have charge of the Alaskan station, the fuel problem has such an important bearing on mining in eastern Alaska, that this matter is to be given immediate attention. With wood at $16 a cord, which is equivalent to paying $30 a ton for coal, placer mining is greatly handicapped in a region where frozen ground must be handled. Since cheaper fuel is a necessity through the continuance of extensive mining operations in the Fairbanks district, a study will be begun at once of the lignite in the Nanana field. A year hence this field will be connected with Fairbanks by rail. The Nanana lignite, however, is of too low grade for use in a raw state. Some method of treating this lignite must be devised. It is believed that this can be done so as to make available a reliable source of fuel supply at a cost materially less than wood. The hope is expressed that a lignite product which will make an excellent fuel can be laid down at Fairbanks for less than one-third of the present price of wood. Another activity of the Fairbanks station will be the encouragement of prospecting for other metals than gold. Tin and platinum are among the metals offering promising development. Since most of the bonanzas are believed to have been discovered, the question confronting placer mining in eastern Alaska is the development of means which will make possible the working of the lower grade of gravels. While placer mining is to be given special prominence in the work of the Fairbanks station lode mining is not to be disregarded. By pointing out certain economies and bringing to general attention some of the mistakes of the past it is believed that lode mining in the Fairbanks district can be stimulated.

TORONTO—Dec. 14

Development of Canada's Iron and steel industry on the Pacific Coast and keeping it out of alien hands have been under consideration lately in British Columbia and in Ottawa. Premier Brewster, of British Columbia, announces that steps will be taken by the provincial government to coöperate with the Dominion government in a plan by which British Columbia ores required for the manufacture of war munitions may be placed under reserve for the use of the Empire and removed from possible control by enemy interests. This statement was made to a deputation of business men of Victoria, who asked for assistance in the development of the iron and steel industries. Premier Brewster will discuss the matter with Sir Robert Borden, Premier of Canada, who will be in British Columbia this week with the view of effecting some arrangement to safeguard imperial interests.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Mine operations in November, reported by Superintendent Houle include 1,883 ft. of development work; continued opening promising oxidized area on 200-ft. level of Southwest claim; most important development was on 100-ft. level, where disclosures to date indicate an ore zone about 40 ft. wide carrying 5% copper ore. Mine shipments in November averaged 600 tons daily of copper ore and 50 tons of lead ore; shipments of latter may be doubled in December.

Gila County

GREATER MIAMI (Miami)—To be developed by three adits; some ore being encountered. No. 1 adit is in about 142 ft.; No. 2 is in 84 ft. and No. 3 is to be started in December to cut the same vein being developed by No. 2 but 300 ft. farther south. H. C. Malloy, manager.

Pima County

NEW CORNELIA COPPER (Ajo)—On Dec. 1, the new 5,000-ton leaching plant was about 90% complete. Coarse-crushing department under cover and only a little concrete work remained to be done; No. 24 gyratory crusher, taking steam-shovel size direct, is practically complete as also the four No. 8 gyratories. The 10,000-ton storage bins were being lined. Fine-crushing plant under roof and five of the eight crushers are in place. All concrete work on leaching tanks finished, and lead lining and wood protection being added; central structure for solution pumps, etc., and asphalt flooring in solution tanks are well along. Reduction of ferric iron is to be accomplished with sulphur dioxide, for producing which will be employed pyrites and four Wedge roasters, Cottrell precipitation for purifying the gas and absorption towers; foundations complete and some steel being erected. One of the two 7,500-kw. turbines about 80% installed. Excavation made for 150x400-ft. cooling pond. First steam shovel, Osgood type, with 4-cu.yd. dipper, now on ground.

Yavapai County

CALUMET & JEROME (Jerome)—McIntosh-Seymour oil engine and Crocker-Wheeler generator now in place. Sinking three-compartment shaft under direction of John Rauber.

GREAT WESTERN SMELTERS CORPORATION (Mayer)—Remodeled smelting plant to start with capacity of 400 tons of Big Ledge and custom ore. Considerable equipment obtained from old United Verde smeltery at Jerome. A. C. Cole, superintendent.

CALIFORNIA

Amador County

SOUTH KEYSTONE (Amador City)—Grading for buildings and machinery; construction under way.

CONSOLIDATED AMADOR (Sutter Creek)—Expected that deepening of Old Eureka shaft for a working shaft will begin early in 1917. New hoist will then be in operation.

SOUTH EUREKA (Sutter Creek)—Forty of the 60 stamps are dropping and it is expected to put the remaining 20 in commission soon. Underground force being rapidly increased. New strike of ore in the Oneida is reported to be improving.

KEYSTONE (Sutter Creek)—Shaft retimbered to 400 ft. below surface; timbers 18x18 in., 18 ft. long, are being used. Large stations with concrete floors and modern appliances for handling ore being constructed at important levels. Company expects to resume regular mining before end of year. C. R. Downs, manager.

CENTRAL EUREKA (Sutter Creek)—Good quartz disclosed by crosscut on 1,800 level, about 650 ft. from station. It is of low grade at point of discovery, but improving as crosscutting progresses. Drifts will be run north and south. Discovery is west of main workings in section where rich rock has heretofore been mined. Fred Jost, superintendent.

Butte County

HEDGE (Oroville)—W. T. Baldwin installed 5-stamp mill; 10 men at work. Will install 1-stamp developing mill on adjoining property in Morris Ravine.

MASCOT (Oroville)—Ore reported to average $15 a ton disclosed and three heavy stamps will be installed for crushing. Mine is near the Banner. W. T. Baldwin, lessee.

BANNER (Oroville)—Strike of rich ore reported on the 400 level in the south drift of the South Banner; 25 men employed. Richard Phillips, manager and principal owner.

MORRIS RAVINE LEASING CO. (Oroville)—Underground station started at old Butterfly mine. Hoist will be installed and gravel mining resumed. Tests in the 1,200 ft. of tunnels, driven this year, indicate pay gravel.

Calaveras County

SOUTH CAROLINA (Angels Camp)—Reported that new operator contemplates exploration of gloryhole to greater depth.

ETNA KING (Angels Camp)—May be reopened; situated between Gold Cliff and Utica. Equipped with hoist, stamp mill and other machinery.

Eldorado County

TUNGSTEN DEPOSITS reported in the Lotus district by the U. S. Geological Survey.

LEMON (Placerville)—Mine to be reopened immediately by Holly Quartz Mining Co., recently incorporated at Fresno. C. E. Stovall is manager.

WOODSIDE (Georgetown)—Reopening of this mine within the town limits depends upon securing easement, 3 ft. wide, across properties in which the town sanitary ditch passes; the easement to provide for carrying off waste water from the mine. Mine owned by Woodside-Eureka Mining Co. A. E. Westover, of Shasta County, will have charge.

Nevada County

SULTANA (Grass Valley)—Rich ore reported at 1,100 ft. from surface. Some time ago company decided to sink vertical shaft 1,700 ft. before drifting or developing. Some prospecting was done, however, when shaft reached 1,100 ft. Albert Crase, superintendent.

EMPIRE-PENNSYLVANIA (Grass Valley)—Reported that these two mines are producing at the rate of $1,250,000 a year and that ore reserves are sufficient for 10 years without further development; 80 stamps are dropping continuously, most of the ore coming from the Empire shaft, which has an incline depth of about 4,600 ft.

Owned by three stockholders and policy of owners is to give out no information, hence these statements cannot be verified.

Plumas County

BONITA COPPER (Portola)—Walker Bros. Consolidated Co., of Salt Lake, has started work. Compressor and drills installed and 20 men will be employed during winter.

Sacramento County

NATOMAS CO. (Natoma)—Two prospecting drills in operation on the William Comstock ranch near Folsom. No. 10 dredge is working on adjoining ground and if Comstock ground proves satisfactory by prospecting, No. 10 will probably continue into the new ground.

San Bernardino County

CALZONA MINES CO. (Vidal)—This copper property, comprising 12 mining claims 8 mi. south of Calzona Junction, has ordered a small mill, and the Calzona Smelting and Refining Co. is to erect a furnace to treat this and custom ores. New compressor and hoist en route. James W. Neill, Pasadena, Calif., consulting engineer; Henning E. Olund, resident engineer.

Shasta County

BALAKLALA CONSOLIDATED (Coram)—Shipping about 300 tons daily to Mammoth smeltery, netting $30,000 to $35,000 per month.

MAMMOTH (Kennett)—Construction of electrolytic zinc plant is progressing rapidly; expect to have building ready for machinery during winter and plant ready to operate in early spring. Friday-Lowden tunnel nearing completion, and laterals will immediately follow.

Sierra County

ROMAN (Sierra City)—Bonded by Richard Phelan, owner, to San Francisco operators. New mill on ground, and active development to begin in spring.

WISCONSIN (Forest City)—Incline shaft, sunk in this gravel mine in 1855, unwatered and sinking continued. Supplies laid in for winter work. D. E. Hayden, manager.

GRAY EAGLE (Downieville)—Drifting under way in two crosscuts at bottom of shaft. Stamp mill, moved to mouth of main tunnel, again in operation; will work all winter with full crew. Sydney C. Love in charge.

Trinity County

TRINITY STAR GOLD DREDGING CO. (Lewiston)—Reported that company will move the old Consolidated dredge from Butte Creek near Chico and install it on Paulsen ranch, near Lewiston.

Tuolumne County

BLACK [illegible]K (Soulsbyville)—A fair-size vein of good or[illegible] isclosed by diamond drilling at the 700 level. Crosscut is being driven to vein. At 1,300 level, south drift has reached a point about 1,400 ft. from shaft. At the 1,800 level, high-grade ore about 4 ft. wide is said to have been opened.

COLORADO

Clear Creek County

TORPEDO (Idaho Springs)—Drifting is in progress on Black Eagle vein. John Hull, superintendent.

FRENCH FLAG (Idaho Springs)—A 2½-ft. vein of $50 gold-copper ore opened in 315-ft. level, 160 ft. west of shaft.

JEAN (Empire)—Being develc[illegible]d by Hager & Co., who have opened payable ore and are shipping from development.

GRAND CLEAR CREEK (Empire)—Development resumed under management of E. R. Willey. Main adit advanced 600 ft.

ARGO MILL (Idaho Springs)—Flotation equipment and additional concentrating tables being installed to increase capacity to 150 tons a day.

HOMESTAKE (Ward)—Rich strike made by John McDonough and associates, of Denver. Vein 2 ft. wide and assays $45 a ton in gold, silver and copper.

NEWTON MILL (Idaho Springs)—Early in January this plant will be remodeled and flotation equipment will be installed. Treats ore from the Gem mine and custom ore.

BRODERICK MINING AND MILLING CO. (Georgetown)—New incorporation of William S. Broderick and associates to develop mining property in Clear Creek County.

MAMMOTH-VIRGIN MINING CO. (Georgetown)—New incorporation of C. D. Smith, R. M. Sanford, and R. W. Street, to develop mines in Clear Creek County. Principal office will be in Denver.

BIG FIVE (Idaho Springs)—Walde & Co. have lease on Edgar No. 2 vein; payable ore opened in breast of drift; raise will be started soon. Roy & Co., leasing on Edgar vein, have advanced drift to total length of 1,100 ft. from tunnel and have raised 180 ft. above tunnel level.

Gilpin County

COLORADO-CARR (Central City)—Oreshoot opened on 800-ft. level; drifting and raising now in progress. Shipping ore averages 20 in. wide.

BECKY SHARP (Russell Gulch)—Lessees have started 360-ft. diamond-drill hole from drift in Old Town mine to tap lowest workings and drain mine through Old Town workings and Newhouse tunnel.

Denver County

SMELTING RATES were discussed on Dec. 7 in Denver by members of a subcommittee of Colorado Metal Mines Association and the smelters. Chief districts dissatisfied with present rates, which are culmination of increasing rates, are: Clear Creek and Gilpin counties and the San Juan district. Claims are made that smelting rates are much lower in Montana and Utah than in Colorado.

COLORADO FUEL AND IRON CO. has given notice of 5% bonus on wages, the same to be paid during December, January and February to all employees who do not lose more than one day per month. This is done to keep mines working full capacity during months when fuel is in greatest demand.

Fremont County

UNITED OIL CO. (Florence)—Improvements to refining works totaling $125,000 contracted.

Mineral County

COMMODORE (Creede)—Reported company will build power plant.

San Juan County

ELK (Silverton)—Being developed by J. J. Cusick and associates.

BLACK PRINCE (Animas Forks)—This property, together with Esmeralda mine, leased to Peter Orella and associates.

SLIDE (Silverton)—This group being developed by John Yager and associates; a 3½-ft. vein recently exposed in drift.

BARSTOW (Ironton)—Leased by C. R. Wilfley and associates. Mine will be developed under superintendence of W. A. Sheldon.

PRECIOUS METALS (Ironton)—R. H. Brown and associates have bonded this Mill Gulch property and have started underground development.

NORTH STAR (Silverton)—Development under way in this property on Sultan Mountain under direction of Matt Delsant. Mill recently overhauled and will be operated under superintendence of L. O. Bastion.

HIGHLAND MARY (Silverton)—Considerable work being done in this property at head of Cunningham Gulch by J. H. Slattery and associates. Mill being remodeled and new equipment installed.

COLUMBUS (Animas Forks)—Development in lower working tunnel being driven by contract under supervision of A. Sturgeon, tunnel will be advanced to intersect the Columbus vein. Arthur Johnson, of Chicago, is manager.

EUREKA MINING AND MILLING CO. (Silverton)—New incorporation, capital $10,000, to develop mining properties in San Juan County. Directors are F. G. Moffatt, Tyson Dines, Jr., and L. E. Rowland, of Denver, where principal office be situated.

BELLE BUTTON MINING CO. (Silverton)—Is developing group of claims in Stony Pass. Operations are financed by E. J. H. Amy, of 44 Wall St., New York, and associates. A 20-ft. vein opened by crosscut tunnel; contains 12 ft. of quartz carrying gold and silver.

San Miguel County

OPHIR GOLD MINES AND REDUCTION CO. (Ophir)—Small force engaged in development under direction of James Belisle.

MORNING STAR (Telluride)—Property on Mt. Wilson being developed by W. R. Vanderveer.

CARRUTHERS (Telluride)—This lease on part of Smuggler-Union ground has completed repairs to Carruthers mill and tramway from mouth of Sheridan crosscut to mill; milling will begin at once.

SILVER BELL (Ophir Loop)—Main tunnel, now in 1,800 ft., will be advanced to prospect veins in the Priest properties. Compressor plant placed in operation and machine drills installed. Frank Trumble, manager.

GERTRUDE (Telluride)—These claims at head of Bear Creek being developed by King & Farrell Leasing Co. Equipped with machine drills and a carload of crude ore produced from development has been shipped to smeltery at Durango.

Summit County

FOUR DREDGES continue to operate in Breckenridge district despite continued intense cold. Three Tonopah dredges somewhat hampered by ice; French Gulch dredge not bothered as it works in running water.

IRON MASK (Kokomo)—Lessees opened wide shoot lead ore.

JESSIE (Breckenridge)—Working 20 men on development. Expects to resume milling soon.

JO DANDY (Breckenridge)—Stoping on high-grade zinc ore. Property adjoins Old Union.

HAMILTON (Breckenridge)—Clearing out mine and repairing buildings preparatory to more extensive operation.

ORO EXTENSION (Breckenridge)—New drill-sharpener installed and better progress being made in crosscut to vein.

MICHIGAN (Kokomo)—Two cars pyritic ore shipped daily to Denver, and occasional shipments of lead ore to Leadville.

PIONEER CONSOLIDATED (Breckenridge)—Remodeled milling plant started recently; ore from Deadwood treated.

PUZZLE (Breckenridge)—Shaft will be sunk 200 ft. from tunnel level and extensive development done. Mill running steadily on dump ore and old stope filling.

IDA BELLE (Montezuma)—Ore shipments discontinued temporarily; trail too slippery for burros. Development work continued; shipments will be resumed after next snow.

BUFFALO LEASING CO. (Dillon)—All legal difficulites in connection with operation of Buffalo placer removed. Preparations being made for hydraulicking next spring.

LEE MINING CO. (Breckenridge)—Shaft will be sunk on Lee placer. Boiler, hoisting plant and pump to be installed at once. Ground cannot be successfully dredged on account of large boulders.

IDAHO

Shoshone County

KELLOGG UNITED MINES CO. (Kellogg)—New company to operate the Sunnyside, Great Western and Atlas groups in Pine Creek district. Theodore Brown, of Kellogg, interested.

CARBONATE HILL (Mullan)—Survey completed for 1,900-ft. crosscut that will give depth of 900 ft. from surface and 240 ft. below present workings. Considerable shipping ore on dump.

JACK WAITE (Union)—Hauling ore to railroad, 10 mi., and expects to ship 100 to 200 tons per month during winter. Shipments average 55% lead with a little silver. May build small mill in spring.

REINDEER-QUEEN MINING (Mullan)—Pres. E. B. Crawford at annual meeting announced erection of a mill likely in the spring. In the property on Willow Creek, about 1,200 ft. of drifts and crosscuts have been driven; 700 ft. yet to go to reach Copper Queen orebody.

DOUGLAS (Beeler)—The Anaconda company, of Butte, which has a lease and bond on this property, is now making regular shipments, four 4-horse teams being engaged hauling ore to the railroad, 10 mi. Compressor, hoist, pump and other equipment now being installed.

POLARIS (Osburn)—Returns from smelter on first car of ore shipped, $3,500. Most of the ore averaged 140 oz. silver and slightly over 5% copper. Company expects to ship three or four cars of such ore a month. Crosscutting to parallel vein, known as Southern Cross; contemplate crosscut during coming year that will give 800 ft. additional depth.

AMBERGRIS MINES CO. (Burke)—New company organized, reducing capital from 3,000,000 to 1,000,000 shares; control secured by Hercules company in settlement of litigation many years ago. Shaft 200 ft. on Ambergris shows 2 or 3 ft. clean galena, with exceptionally high silver. Shaft sunk near north line of Hercules, which led to the litigation. Crosscut, now being run from No. 4 tunnel of Hercules, will cut Ambergris orebody at depth of 1,000 ft. or more. Announced that property will be made productive as quickly as possible. Company has right to use Hercules tunnels and aërial tramway to railroad.

MICHIGAN

Copper

DIAMOND-DRILL EXPLORATION will soon be started near the town of Salo on NW ¼, Sec. 35, on the Hancock side of the route to the Portage Canal. The work will be done by the E. J. Longyear company, presumably for George North, who has held options on land in this vicinity for many years.

OSCEOLA (Osceola)—Daily tonnage about 4,700 tons, practically the full capacity of the mill.

COPPER RANGE (Painesdale)—Steelwork for the latest addition to the Champion regrinding mill has been completed.

NEW BALTIC (Houghton)—At depth of 65 ft., has entered the New Arcadian lode, showing good amygdaloid characteristics.

HANCOCK (Hancock)—Noticeable increase in tonnage this month. Last month about 24,000 tons was mined, but development work restricted output.

ADVENTURE (Greenland)—First shipment of rock to Winona mill; large proportion of the ore came from the Butler lode. Unwatering of shaft continues.

WINONA (Winona)—Has solved fuel problem by ordering in Illinois whence the coal will be sent by rail. One head of mill running regularly on Winona rock.

FRANKLIN (Demmon)—Has installed compressed-air haulage on 30th level; this, with first installation on 29th level, is sending up about 600 tons daily; a third installation is to follow.

ISLE ROYALE (Houghton)—Mining nearly 3,300 a day now. The newer shafts showing rock carrying about 14 lb. to the ton—quite as good as expected. Plans for improvements at No. 6 rockhouse approved.

NEW ARCADIAN (Houghton)—New crusher installed, and new rockhouse engine will soon be in. New rockhouse will be in commission about Jan. 1. Rails are being laid from the 1,250-ft. to the 1,500-ft. level.

CALUMET & HECLA (Calumet)—Production in November for Calumet & Hecla and subsidiaries was: Ahmeek, 2,157,959 lb.; Allouez, 815,458;

Calumet & Hecla, 6,513,333; Centennial, 155,505; Isle Royale, 1,036,492; La Salle, 135,220; Osceola, 1,533,944; Superior, 204,487; Tamarack, 504,831; White Pine, 314,534 lb.

MISSOURI

Joplin District

FLANNERY ZINC (Sarcoxie)—Contract let for rebuilding mill burned Dec. 2; cost about $40,000; capacity 250 tons per 10-hr. shift; to be completed in 45 days.

LONDON LIFE (Joplin)—With only two men underground, made carload of calamine and lead concentrate during recent week. Operating at 60 ft. on Roaring Springs land.

GEORGE MOORE and associates, of Webb City, have taken 13-acre lease just south of St. Regis mill at Chitwood and now doing check drilling. Will probably erect 250-ton mill.

POOR BOY'S (Joplin)—John Davis has bought out Jesse Ader and associates of Webb City and will increase development operations at mine, 9 mi. north of Joplin, in new territory.

CONCORD (Webb City)—Building 250-ton mill on Zinc Corporation land south of Carterville. To be steam plant. Crane, Wenk and Philip Gray, of Webb City, who recently built 500-ton Unity mill, principal owners.

OSCEOLA (Webb City)—No. 1 mill, under lease to Cisco company, destroyed by fire Dec. 16; insured for $5,000; was 300-ton mill, but old. To be rebuilt immediately at cost of $40,000. T. F. Coyne and A. D. Hatton principal owners.

MISSOURI MINING CO. (Joplin)—Has about completed new 150-ton mill on old Frisco tract at Thoms Station. Mine developed as hand-jig operation, and at first was principally lead producer. Arthur Raymond, president of Oronogo Circle Co., interested.

REBECCA (Joplin)—Will resume charge of La Nora B mine at Chitwood, Jan. 1. For several months property has been operated by George Bayless, to prove contention of landowners that it is paying mine. Bayless employed by Rebecca company to continue as manager.

UNDERWRITERS (Joplin)—Have moved Geronimo and Purciller mills from West Joplin camp to Oklahoma field. One has been completed in Century camp and the other now being erected 1 mi. east of Picher, Okla. No. 1 mine at Century is producing 150 tons of concentrates weekly from 1,500 tons of ore.

MONTANA

Beaverhead County

BANNACK GOLD MINING (Bannack)—Great activity reported at company's Original Bannack mine, 11 mi. from Grant, Mont., to which ore is to be hauled by motor trucks recently purchased. Sixty men engaged on development, and bins and chutes filled with gold ore. The 200-ton mill completed but will not be put into operation until March, due to lack of waterpower during winter months, the newly ordered oil engine not having yet arrived.

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—November was banner month in company's history. Output $80,024 in gold; $12,524 came from North Mocassin mine at Kendall, being the yield from 2,242 tons of ore; balance came from Piegan-Gloster and Shannon in Lewis and Clark County, 3,093 tons of Shannon ore averaging $15.80 per ton and 2,196 tons of Piegan-Gloster ore averaging $8 per ton.

Granite County

MONTANA MANGANESE CO. (Philipsburg)—Manganese ore mined from limestone beds about 1 mi. from town, being shipped to Eastern market. Production about 40 tons daily by hand mining; will be increased to 100 tons with four new machine drills and 10x12-in. compressor driven by 50-hp. motor. Ore hauled to railroad by auto trucks.

Jefferson County

BOSTIN & CORBIN (Corbin)—November production was 831 tons of concentrates.

Silver Bow County

TUOLUMNE (Butte)—First shipment from strike at Main Range property made Nov. 9. Will erect 1,000-ton storage bins and ship to Washoe smeltery steadily.

BUTTE & LONDON (Butte)—Crosscutting on 1,600 level is nearing completion by Rainbow Development Co. which is to receive 51% of the Butte & London stock for this work.

BULLWHACKER (Butte)—Syndicate, operating the Bullwhacker mine under lease and bond, reports daily shipments of 125 tons of 3½% ore, partly to Granby smeltery and partly to the East Butte's plant. November profits greater than for entire preceding nine months. The Wall syndicate has paid so far a total of $115,000 for 230,000 shares of Bullwhacker stock. Car shortage restricts output.

ANACONDA (Butte)—Sunday, Dec. 10, company's Butte mines were closed for two shifts because of inability to move ore as fast as taken out. Plenty of ore at company's Washoe and Great Falls works and employees at these plants were not affected by the shutdown. Break-out of casting furnace at Washoe works Dec. 11 caused injury of four men who were removed to hospital, though burns are not considered serious.

NEVADA

Esmeralda County

SPEARHEAD (Goldfield)—Shaft recently encountered shale, and station being cut at 910-ft. point, from where lateral development of the contact will be undertaken.

REORGANIZED KEWANAS (Goldfield)—At a point about 800 ft. northerly from main working winze, 3 ft. of ore has been encountered a short distance above shale contact. Raise being driven on the showing.

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 9 was 9,952 tons, valued at $195,076, compared with 9,747 tons for week previous. Producers were: Tonopah Belmont, 2,992 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,300; Jim Butler, 950; West End, 814; Halifax, 210; Rescue-Eula, 194; McNamara, 52; miscellaneous, 60 tons.

WEST END (Tonopah)—Sinking Ohio shaft. Now down about 900 ft.

MONARCH PITTSBURGH (Tonopah)—Crosscutting on 850-ft. level to connect with raise from 1,000-ft. level that recently encountered ore. About 400 ft. to go.

GREAT WESTERN (Tonopah)—Unwatering of lower levels completed; additional pump placed, giving total pumping capacity of 500 gal. per min. Lateral development to be resumed.

MONTANA TONOPAH (Tonopah)—Has bonded property of Lost Burros Gold Mining Co. in Inyo County, Calif. Consideration $40,000. About 10,000 tons of mill ore "blocked"; development faces being extended. Expect to have 50-ton mill in operation by March.

White Pine County

CONSOLIDATED COPPERMINES CO. (Kimberly)—Financing of company assured by Albert E. Humphreys and associates, of Charleston, W. Va., and Denver, Colo., and property will be put on substantial operating basis; funds provided to meet the Giroux bonds when they fall due and the floating indebtedness is expected to be cleared up by middle of January. Mr. Humphreys will become the financial advisor and take active part in the management. The remodeling of the Giroux concentrator into 500-ton flotation mill will be completed early in January and another 500-ton unit will be constructed. Output will be brought up to 1,000 tons daily as soon as possible. Development of low-grade disseminated ores will also be resumed as soon as weather permits, with 10 churn drills. Charles H. Boynton, president, 60 Broadway, New York; Elmer F. Gray, manager.

NEW MEXICO

Grant County

CHINO DEL NORTE COPPER CO. (Hanover)—New incorporation to develop 30 claims on Hanover Mountain, north of the Chino. George E. Coxe, I. J. Ketman, of Winterset, Iowa, and W. A. Ulman, of 233 Broadway, New York, interested.

OREGON

ELDORADO COPPER MINING CO. (Riddle)—New incorporation to operate the old Banfield mine, 32 mi. east of Riddle. Workings include six adits. Andrew Laidlaw, of Spokane, Wash., interested.

PENNSYLVANIA

CHARLES M. SCHWAB reported to have acquired from Lackawanna Steel Co. control of the Cornwall iron-ore mines and furnaces; also outright purchase of American Steel and Iron plants including steel mill; Lebanon furnaces and concentrator; and the Polebrook furnaces.

CAMBRIA STEEL CO. (Johnstown)—At recent directors meeting of Midvale Steel and Ordnance Co. in Philadelphia, immediate erection of two more blast furnaces was ordered. It is understood that one will be used for production of ferromanganese and the other for special irons.

WASHINGTON

LEAD-ZINC MINING CO. (Metaline)—New York men reported interested and $50,000 provided for increasing output, raising mill from 125 to 250 tons capacity. New electric hoist and compressor being installed. Wide sulphide orebody, free from pyrite, opened for 600 ft.; diamond drilling to be done from 550-ft. level. Lewis P. Larsen, president and manager.

WISCONSIN

Zinc-Lead District

EWING (Benton)—Company reports rich drillings on land adjoining old Etna mine.

VANDERVENDER (Benton)—Rich lead ore found below the old mine workings at Benton.

BUCHAN (Benton)—New shaft penetrated good vein of zinc ore on Buchan land at Benton.

G. O. P. (Platteville)—Good strike of ore at old Gritty Six mine on the Raisbeck range, near Cuba City.

FRONTIER (Benton)—Another 25-ton mill completed on the Grotkin land, ¼ mi. south of Bull Moose No. 1.

MINERAL POINT ZINC (Galena, Ill.)—A new shaft will be sunk and complete surface equipment erected on Meloy land in Benton-New Diggings camp; to be known as the Hoskins mine.

CANADA

British Columbia

BELL (Beaverdell)—This Westkettle River property has commenced shipments of gold-silver ore to Trail.

ST. EUGENE (Moyie)—Concentrator being remodeled to treat lead-zinc ore from Sullivan mine at Kimberly.

LANARK MINING (Illicillewaet)—Erecting 150-ton mill; to be ready in February; William B. Dornberg, manager. Tousley-Ely Co., of Spokane, Wash., interested.

CONSOLIDATED MINING AND SMELTING (Trail)—Has decided to enlarge its electrolytic copper refinery, increasing its present output 50% or to about 15 tons daily.

GRANBY CONSOLIDATED (Vancouver)—Production for November 4,151,000 lb. copper, of which 3,017,260 lb. was produced at Anyox and 1,133,740 lb. at Grand Forks plant.

Manitoba

TONOPAH MINING (Schist Lake, via The Pas)—At the copper deposit being developed by this Philadelphia company arrangements are being made to take out 5,000 tons during the winter. The ore will be hauled to Sturgeon Portage, 38 mi. distant, whence it will be transported by water to The Pas from which it will be shipped to the smeltery at Trail, B. C. Company has placed large orders for machinery and is considering building of an 18-mi. railway between the end of navigation on Schist Lake and Sturgeon Portage.

Ontario

McKINLEY-DARRAGH (Cobalt)—Order given for new ball mill to take the place of gravity stamps.

INSPIRATION (Porcupine)—Diamond drill cores from depth of 285 ft. showing good mineralization.

THOMPSON-KRIST (Porcupine)—Contract let for diamond drilling to begin first week in January.

MATTHEWS (Mine Centre)—In this claim, development is being undertaken on a copper vein believed to be a continuation of the Mine Centre vein.

KERR LAKE (Cobalt)—Production for November was 215,840 oz. of silver, compared with 210,073 oz. in October. Production for eleven months of 1916 was 2,343,645 oz.

APEX (Porcupine)—Diamond drilling started. Shaft will be put down from 125 ft. to 300 ft. and crosscuts run to cut veins coming in from West Dome and Dome Lake.

NIPISSING (Cobalt)—In November, ore was mined of an estimated value of $246,629 and shipments made of bullion from Nipissing and customs ore of estimated net value of $372,636.

DAVIDSON—(Porcupine)—New vein, found at depth of 50 ft. in south shaft, is showing well. Bottom of shaft is in solid mineralized quartz with plentiful showings of free gold.

MINERAL PRODUCTS CO. (Madoc)—This company, of which Charles A. Darborn, West Somerville, Mass., is president and Charles R. Ross, manager, has commenced operations on a fluorspar property.

ALGOMA STEEL CORPORATION (Sault Ste. Marie)—It is understood that this company has let the contract for 4,000 ft. of diamond drilling at the Helen mine to the E. J. Longyear Co. of Minneapolis, Minn.

MINE CENTRE COPPER CO. (Mine Centre)—Company, which owns 8 claims, has shipped six cars of copper ore to the Trail smeltery from a vein 60 ft. wide carrying sulphides of copper and low gold contents. Will build concentrator during winter.

BEAVER (Cobalt)—Report for quarter ended Nov. 30 shows bullion, and ore at smeltery and mine 274,341 oz. and cash on hand $71,452. Vein found on 600-ft. level carrying 1,500-oz. ore; proved for 35 ft. Mill rock and some high-grade ore being recovered on 700-ft. level. Small stringers encountered in 400 ft. of crosscutting on 1,600-ft. level. On McKane claim, Kirkland Lake, shaft sunk from 300- to 400-ft. level; on latter level vein has been crosscut for 11 ft. without reaching south wall.

PERU

CERRO VERDE property of Carlos Lohmann acquired by William Braden, presumably for Anaconda or Andes Exploration Co. account. Property is 12 km. from Tiabaya station on the Ferrocarril del Sur and 161 km. from port of Mollendo.

SPITZENBERGEN

NORWEGIAN SYNDICATE, capitalized at about $2,680,000 and headed by the Central Bank of Norway, has purchased control of the Arctic Coal Co. from John M. Longyear and Frederick Ayer, of Boston, Mass. At different times, these coal mines have been sought by Russian and German interests.

The Market Report

Metal Markets

NEW YORK—Dec. 20, 1916

During the last week all of the markets were unsettled and lower, as was the case with most commodities and with the stock market.

Copper, Tin, Lead and Zinc

Copper—Following the peace proposal of Dec. 12, the market wavered. By Dec. 14 it was certain that copper was going to be offered for resale by consumers, and, indeed, such offerings developed in many quarters and for fairly liberal quantities. It was surprising how much copper turned up for sale, both for prompt and first-quarter delivery, in this market which had been so tight only a few days previous. Some first hands also found that they had some early copper to offer. As previously expressed, suspicion that some consumers had overbought proved to be correct. Observing the turn of the tide, those who purchased copper lower down and had a surplus of it were glad to take a profit. On the other hand, the opinion that some consumers had not covered their first-quarter requirements proved also to be correct, and some of these were buyers on the decline, while others expressed their intention of holding aloof until they could buy more cheaply. The transactions of the week naturally were small, but such as there were, together with offers and bids, gave a fair reflection of the market. Some first hands offered copper for delivery far ahead at relatively low prices, but we heard of no such transactions and such offers were, of course, purely speculative. The major market, which a fortnight ago was for second-quarter delivery, became this week for near-by and first-quarter. The premium on prompt copper has practically vanished.

Copper Sheets—The base price for copper sheets is at 42c. for hot rolled and 43c. for cold rolled. Wire is based on 37c., f.o.b. mill.

Tin—This market declined on small business. At the opening of the week spot was 42⅞c., and futures, 41⅞c. At the close, spot was 41⅞c. and futures, 41c.

Lead—This market declined further on the liquidation of speculative holdings and probably also on some bear selling. Some producers reported no sales, being entirely sold out up to February, and other producers found that they had lead available both for prompt and January delivery, and some round lots were sold at 7½c., New York, but later second hands were sellers at 7¼c. Some sellers made no distinction between St. Louis basis and New York basis, and the St. Louis market did not decline quite so much as New York. There were inquiries in the market from abroad, including some from Denmark, South America and Japan.

In the Dec. 16 issue of the "Journal" the price of lead at New York on Dec. 8 was given as 7⅝@7¾. By a typographical error the latter figure was wrongly printed—the correct price range was 7⅝@7⅞.

Spelter—At the beginning of the week, this market went off sharply. On Dec. 16 buyers became interested, especially galvanizers. The market meeting with some resistance, the decline was not only stayed, but there was a trifling advance. However, the buying demand petered out on Dec. 18 and the market again sold off, closing weak. Throughout the week, however, the largest producers held aloof, most of them asking 11c.

In the "Journal" of last week some of the copies were blurred in printing so that the quotation of Dec. 13 on St. Louis spelter was not altogether clear. The correct quotation was 10⅞@11.

Imports at Baltimore during the week included 5,545 tons of zinc ore from Cartagena, Spain.

Zinc Sheets—The price of zinc sheets remains based on $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—Market quiet but firmer at 14½@15c. January-February shipment from China quoted at 13@13½c., c.i.f., New York, duty unpaid.

Quicksilver—Market quiet, but steady at $80. San Francisco reports by telegraph $78, firm.

Aluminum—Quotations remain nominally unchanged at 63@65c. per lb. for No. 1 ingots, New York. The market is very quiet, practically no transactions taking place.

Nickel—There is no change in the market quotation, prices remaining at 45@50c. per lb.; electrolytic commanding an extra 5c. per lb.

Gold, Silver and Platinum

NEW YORK—Dec. 20

Gold—J. P. Morgan & Co. deposited about $10,000,000 more gold at the Assay Office on Dec. 12, a shipment from Ottawa for account of the British Government. The inflow of gold to New York and Philadelphia during the last week has amounted to $27,000,000. Since Jan. 1 about $608,500,000 of the metal has come into the country.

The shipments of the 13th and 14th were partly in Russian and French coin, being drawn from the fund accumulated by Great Britain from her Allies' stores in the last two years. The total of $35,000,000 awaiting smelting at the Assay Office last night was enough to supply seven days' work for the plant, and because of this congestion it is expected in banking quarters that continued shipments will be made to Philadelphia and San Francisco if the gold movement continues on a broad scale.

Silver—Market continues steady with good undertone, but no new features present themselves. Latest letters from London indicate the demand on the Indian Treasury for rupees has been very great. This necessitates further silver coinage as from date of Dec. 1.

Under date of Nov. 30, Samuel Montagu & Co., London, report that although purchases have not been made upon any substantial scale on account of China, the firmness of exchanges from that quarter has not been without effect upon prices, for it has acted as a deterrent to sellers. Prices have advanced without a check, though with pauses, from 34 1/16 to 35 1/16 d., but no sensational rises have taken place as was the case in May last. Selling has been fitful in amount and on the whole, sluggish. Buying has been varied in character and comprised some orders from the Indian Bazaars. The stock in London was reported on the 24th inst. as 8,360,000 standard ounces, an increase of about 600,000 since the 27th of last month. A considerable portion of the stock, however, was earmarked and not available for resale.

It will be observed from the figures given below that during one week the net shrinkage of the silver holding in the Indian treasuries, inclusive of fresh coinage, amounted to about 14,000,000 rupees. To replace this amount the quantity of silver required would be almost equal to the present stock in Bombay. The decline has not been spasmodic, but almost without a break from July 31 last, when the total holding was over 28,000,000 rupees. During this time very large additions of fresh minted coin have been made.

Mexican dollars for Dec. 18, 19 and 20 are quoted at 59½@62½c.

Platinum—Market dull and weaker. We quote $80@82.50.

Palladium—Declined to $60 per oz.

Iridium—Quoted at $150 per oz.

Zinc and Lead Ore Markets

Joplin, Dec. 16—Price quotation per 2,000 lb.: Blende, high $96.70, 60% zinc, premium ore $95, medium $90@85, low $80; calamine per ton, 40% zinc, $60@50; average selling price, all grades of zinc, $87.72 per ton.

Lead, high price, $99.60; base, $99@96; average selling price, all grades of lead, $91.90 per ton.

Shipments of the week: Blende, 7,642 tons; calamine, 475 tons; lead, 1,176 tons. Value, all ore the week, $820,110; 50 weeks, $36,586,720.

Peace talk seems to have wrecked the metal market and the ore market has suffered to some extent, but the apparent shortage in production prevents lowering ore prices on a plane with the metal.

Sellers of zinc ore take no stock in the peace talk and very little ore was offered for sale this week, the week's shipment being from advance purchases.

Other Ores

Tungsten Ore—Market was nervous on announcement of German peace proposals. At the close we quote $17@19 per unit.

Charles Hardy reports under date of Dec. 19 as follows: "One of the most interesting weeks has been experienced in the tungsten market, as immediately after my last market letter was issued, the German peace proposal became known and the market hesitated to see how an early peace would affect the tungsten position. Inquiries as to the market outlook reached me from all quarters and through its being fully provided with orders, it was easy to absorb such small quantities as came upon the market from nervous sellers. As Germany has in peace time been the biggest consumer of tungsten ore, an early peace would not affect the price downward, but rather upward for the first few months, as undoubtedly a heavy buying movement would start for consumption in Europe. Independent, however, of the prospects of peace, Great Britain and France appeared again in the market as buyers on a large scale during the past fortnight and closed not only prompt deliveries, but also contracts to cover requirements for the next six months. The price paid ranged from $16.50 to $18; the latter price was paid for high-grade Argentine ore. At the moment of writing, one of our greatest home consumers has come into the market for large quantities and the market is quite firm from prices of $17.50 to $20, according to grade and position. The tungsten position in Great Britain has been such, that though the 30 largest users of tungsten combined to build their

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Dec.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
14	4 7550	75⅞	36⅜	18	4.7550	76⅛	36 1/16
15	4.7563	76⅛	37	19	4.7544	76⅛	36 1/16
16	4.7563	76⅛	36 1/16	20	4.7544	76⅛	36 1/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
14	33 @33½ 32½	42⅛	7½ 7⅜ 7⅜	7½ 7⅜ 7⅜	10½ @10½ 9⅜
15	@33 32½	42⅛	@7½ 7⅜	@7½ 7⅜	@10 9⅜
16	@32½ 32¼	42⅛	@7½ 7⅜	@7½ 7⅜	@10¼ 10
18	@32⅜ 32	42½	@7½ 7⅜	@7½ 7¼	@10⅛ 9⅜
19	@32½ 31	42⅝	@7½ 7⅜	@7½ 7¼	@10 9⅛
20	@32	41⅞	@7½	@7½	@ 9⅜

The above quotations are our appraisal of the average of the major market based on sales as made and reported by producers and agencies; and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Dec.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
14	142⅛	136½	164	184½	186	30½	56½
15	142⅛	136½	164	184½	186½	30½	56½
16							
18	142⅛	136½	162	183	185	30½	55
19	142⅛	136½	161	182½	184½	30½	54½
20	142⅛	136½	160	181	183	30½	54½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

own works for the reduction of tungsten, these works have not been able to work continuously, being hampered by a shortage of ore supplies. The prospects of the tungsten market are that prices will not only be manitained, but will have a tendency to harden."

Antimony Ore is difficult to obtain and buyers are reported offering as high as $1.70 per unit c.i.f., New York.

Manganese Ore—Higher prices are being named on Indian manganese ore at tidewater principally as a result of freight rate increases, although the offering supply of ore also is limited. A quotation was made yesterday at a shade under 78c. a unit, at tidewater. A large eastern Pennsylvania consumer reports Brazilian ore may be had at around 60c. a unit, delivered at Eastern seaboard. This figure is out of line with that commonly heard in the market and some sellers will not entertain less than 70c.

Imports at Baltimore during the week included 7,000 tons of manganese ore from Brazil.

Iron Trade Review

NEW YORK—Dec. 20

The outstanding feature of the week's market has been the German peace suggestion and the consequent panic-like decline in stocks. In the actual market for the metal itself there has been no great change and no perceptible effect of the peace proposition. The trade is dominated, undoubtedly, by the belief that at this date no basis of agreement can be found upon which the war can be ended soon. The consensus of opinion seems to be that, while there may be some talk about peace, and it may go so far as to result in a congress of representatives of different governments, yet reaching of peace terms is unlikely.

PITTSBURGH—Dec. 19

The entire iron and steel market has suddenly slowed down in the past week and is now distinctly quiet. There is scarcely any inquiry for deliveries after the middle of next year, and not a great deal for the earlier deliveries. Such inquiry could not result in much business in any event because the mills are already so well sold up. There is no weakness whatever in prices, which are as firmly maintained as ever, but the sharply advancing tendency of the market, which was exemplified by continued advances in one product or another until a week or two ago, has evidently been arrested.

The German peace proposal, news of which reached large buyers and sellers a few hours after last week's report was written, resulted in some dimunition in buyers' enthusiasm, for the next morning's mail, brought less than the usual amount of inquiry. The possibilities of the overture really leading to peace are appraised higher in the trade than a week ago. All of the slowing down that has occurred is not to be attributed to the peace proposal, however, for trade was marked to slow down within a short time, the pace of November, when the Steel Corporation booked nearly twice as much tonnage as it shipped, could not be maintained when the mills were already so well filled, while a slowing down in the market always occurs a few days before Christmas.

The transportation situation has grown worse. Car shortages are still more pronounced, while a great many embargoes have been placed. The New York Central has an embargo against the Pittsburgh & Lake Erie as to shipments east, except export material with a special permit, and there are various other embargoes. Steel continues to accumulate at some mills and while the tonnage is not large in proportion to production it is large compared with storage facilities, and if improvement in transportation does not come within a week or two a curtailment in production at some points will be forced.

Pig Iron—Demand for pig iron has become very light for the late deliveries but there is occasional urgent inquiry for prompt and first quarter iron. The slowing down in demand only makes the showing clearer that early delivery iron is very scarce, for offerings have not increased. Malleable is very difficult to find at any price. Production at the merchant furnaces has probably been curtailed somewhat by the coke scarcity, but as yet not seriously. One Shenango valley furnace is banked. We quote: Bessemer, $35@37; basic, $30; foundry, second half, $30; prompt, $31@32; malleable, prompt, $32@33; forge, $29@30, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Bids for billets for export have advanced, and in some cases it is possible $60 could be obtained. There is practically nothing being done in the domestic market. We quote: Billets, $55@60; sheet bars, $57@62; rods, $70@75; forging billets, $80.

FERROALLOYS

Ferromanganese—Domestic producers of ferromanganese recently began advancing prices, and all are now up to $175 for spot or contract, an advance of $10. Imported on contract remains at $164, and there is no prompt imported as deliveries are behind on contracts.

Spiegeleisen—Spot and contract is quoted $50@55 per ton.

Ferrosilicon—Quotations on 50% material are at $100 per ton. For 10% bessemer ferrosilicon the figure of $42 is asked.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 19
Alaska Gold M.	12½
Alaska Juneau	7½
Am.Sm.&Ref.,com.	106¾
Am. Sm. & Ref., pf.	114½
Am. Sm. Sec., pf. A	98
Am. Sm. Sec., pf. B.	94½
Am. Zinc	44½
Am. Zinc, pf.	75
Anaconda	86⅛
Batopilas Min.	1¼
Bethlehem Steel	540
Bethlehem Steel, pf.	145
Butte & Superior	51
Chile Cop.	26½
Chino	55½
Colo.Fuel & Iron	47
Crucible Steel	66½
Dome Mines	20½
Federal M. & S.	13
Federal M. & S., pf.	42
Great Nor., ore ctf.	39
Greene Cananea	46
Homestake	132
Inspiration Con.	58½
International Nickel	43
Kennecott	47
Lackawanna Steel	88
Miami Copper	39½
Nat'l Lead, com.	61½
National Lead, pf.	110
Nev. Consol.	25½
Ontario Min.	6⅝
Quicksilver	2
Quicksilver, pf.	2½
Ray Con.	27⅞
Republic I.&S. com.	79¼
Republic I. & S. pf.	107
Sloss-Sheffield	64½
Tennessee C. & M.	19
U. S. Steel, com.	112
U. S. Steel, pf.	119
Utah Copper	103½
Va. Iron C. & C.	52

N. Y. CURB†	Dec. 19
Buffalo Mines	1.10
Butte & N. Y.	1½
Butte C. & Z.	11⅛
Caledonia	.50
Can. Cop. Corpn.	1¼
Cashboy	.07
Cerro de Pasco	39½
Con. Ariz. Sm.	2 1/16
Con. Coppermines	4 1/16
Con. Nev.-Utah	.18¾
Crystal Cop.	1
First Nat. Cop.	3⅛
Florence	.80
Goldfield Con.	.55
Goldfield Merger	.06½
Granite	.50
Hecla Min.	7⅛
Howe Sound	7
Jerome Verde	1½
Joplin Ore & Spel.	.35
Kerr Lake	4½
Magma	.40
Majestic	.81½
McKinley-Dar-Sa.	.50
Mother Lode	.44
Nevada Hills	.21
N. Y. & Hond.	16½
Nipissing Mines	9
Oro	‡.03½
Ray Hercules	4
Rochester Mines	.70
St. Joseph Lead	17
Standard S. L.	1 1/16
Stewart	.25
Success	.46
Tonopah	4½
Tonopah Ex.	4½
Tribullion	.37½
Troy Arizona	.55
United Zinc	4½
White Knob, pf.	2½
White Oaks	3½
Yukon Gold	2½

SAN FRAN.*	Dec. 19
Alta	.04
Andes	.18
Best & Belcher	.06
Bullion	.01
Caledonia	.25
Challenge Con.	.06
Confidence	.10
Cons. Imperial	‡.01
Con. Virginia	.10
Gould & Curry	.03
Hale & Norcross	.09
Jacket-Cr. Pt.	.03
Mexican	.19
Occidental	.65
Ophir	.17
Overman	.06
Savage	.05
Seg Belcher	.02
Sierra Nevada	.19
Union Con.	.54
Utah Con.	.02
Belmont	4.65
Jim Butler	.84
MacNamara	.06
Midway	.21
Mont.-Tonopah	.18
North Star	.13
Rescue Eula	.25
West End Con.	.70
Atlanta	.09
Booth	.09
C.O.D. Con.	‡.02
Comb. Frac.	.05
D'field B.B.	.04
D'field Daisy	.04
Jumbo Extension	.27
Round Mountain	.38
Sandstorm Kendall	‡.04
Silver Pick	.27
Argo	.06
Ariz. Central	.10
Big Jim	1.25
Lazy Boy	.05
Nellie	.29
Tom Reed	1.90
United Eastern	5.10
United Western	.04

BOSTON EXCH.*	Dec. 19
Adventure	4
Ahmeek	110
Algomah	1½
Allouez	66½
Ariz. Com., ctfs.	14¾
Bonanza	‡.40
Butte-Balaklava	2
Calumet & Ariz.	80
Calumet & Hecla	545
Centennial	19½
Copper Range	68
Daly West	3
East Butte	16½
Franklin	9½
Granby	93½
Hancock	16½
Hedley	24
Helvetia	.90
Indiana	4
Island Cr'k, com.	65½
Isle Royale	36½
Keweenaw	4
Lake	14¼
La Salle	4
Mason Valley	6
Mass	15½
Mayflower	40
Michigan	3½
Mohawk	96½
New Arcadian	5½
New Idria	16
North Butte	24½
North Lake	2
Ojibway	2½
Old Colony	2½
Old Dominion	66
Osceola	94
Quincy	90
St. Mary's M. L.	93
Santa Fe	2
Shannon	9¼
Shattuck-Ariz.	28
So. Lake	5
So. Utah	.36
Superior	16
Superior & Bost.	5½
Tamarack	43½
Trinity	6⅝
Tuolumne	2
U. S. Smelting	66½
U. S. Smelt'g, pf.	52
Utah Apex	3⅜
Utah Con.	18½
Utah Metal	6½
Victoria	6½
Winona	5
Wolverine	48
Wyandot	1½

BOSTON CURB*	Dec. 19
Alaska Mines Corp.	.92
Bingham Mines	9¾
Boston Ely	.55
Boston & Mont.	.61
Butte & Lon'n Dev.	.50
Calaveras	.5
Calumet-Corbin	.01½
Chief Con.	2⅛
Cortez	25
Crown Reserve	40
Davis-Daly	26⅛
Eagle & Blue Bell	1⅛
Houghton Copper	1⅛
Iron Cap Cop., pf.	17
Mexican Metals	.40
Mines of America	2
Mojave Tungsten	1½
Nat. Zinc & Lead	.60
Nevada-Douglas	1⅞
New Baltic	2¾
New Cornelia	16⅛
Ohio Copper	1½
Oneco	.75
Rex Cons.	.45
Rilla	.06
United Verde Ext.	38½

SALT LAKE*	Dec. 19
Big Four	1.10
Black Jack	.05
Cardiff	7.25
Colorado Mining	.16½
Crown Point	.04½
Daly-Judge	8.50
Emma Cop.	1.50
Empire Copper	1.50
Gold Chain	.15
Grand Central	.52
Iron Blossom	1.17
Lower Mammoth	.06½
May Day	.10½
Opohongo	‡.01
Prince Con.	1.20
Seven Troughs	‡.03
Silver-King Coal'n.	3.30
Silver King Con.	4.55
Sioux Con.	.12½
So. Hecla	1.30
Uncle Sam	.06
Wilbert	.09
Yankee	.20

TORONTO*	Dec. 19
Bailey	.06½
Beaver Con.	.43
Chambers Ferland	.16
Coniagas	4.75
La Rose	.56
Peterson Lake	.17
Right of Way	.05
Seneca Superior	‡.09
T. & Hudson Bay	72.00
Temiskaming	.61½
Wettlaufer-Lor.	.09
Dome Exten.	.24
Dome Lake	.62
Foley O'Brien	.70
Hollinger	6.80
Jupiter	.27
McIntyre	1.80
Newray	.54
Porcu. Crown	.67
Vipond	.46
West Dome	.33

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 19
Cresson Con.	7.25
Doctor Jack Pot.	.09
Elkton Con.	.12
El Paso	.44
Findlay	.07
Gold Sovereign	.06½
Golden Cycle	2.64
Granite	.50
Isabella	‡.22½
Mary McKinney	.28
Portland	2.00
Vindicator	1.30

LONDON	Dec. 4		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	15	0
Burma Corp.	3	13	9
Cam & Motor	0	12	0
Camp Bird	0	6	6
El Oro	0	7	6
Esperanza	0	10	0
Mexico Mines	3	10	0
Nechi, pfd.	0	12	0
Oroville	0	15	9
Santa Ger't'dis	0	9	6
Tomboy	1	1	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	71.604	22.703	25.094	34.192
Dec.	49.375	54.971		22.900	26.373	
Year	54.811	49.684		25.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	147.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	34.071
Oct.	17.686	27.193	72.601	122.750	88.000	42.523
Nov.	18.627	30.625	77.744	134.659	93.273	5.432
Dec.	20.133		80.773		100.430	
Year	17.275		72.532			

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.83	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	44.109	167.670	186.932
December	38.779		167.000	
Av. year	38.590		163.960	

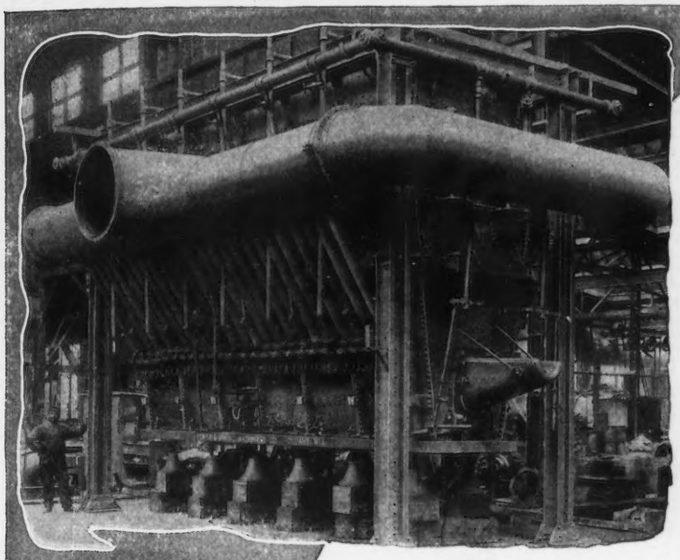
Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	7.042	5.078	6.945	26.278	30.500
December	5.355		5.266		28.807	
Year	4.673		4.567		22.917	

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	13.915	6.211	16.745	30.844	89.810
Feb.	8.436	13.420	8.255	18.260	39.819	97.762
Mar.	8.521	15.346	8.360	16.676	44.141	95.048
April	10.012	16.595	9.837	16.525	49.888	99.056
May	12.781	12.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.300	9.820	12.596	9.659	66.536	54.159
Nov.	15.962	11.552	15.792	11.422	88.409	56.023
Dec.	15.391		15.221		89.400	
Year	13.230		13.054		67.553	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
Novemoer	17.57	29.12	16.47	27.23	17.20	25.60
December	19.97		18.44		18.95	
Year	$15.82		$14.76		$14.95	

‡ As reported by W. P. Snyder & Co.



Copper Blast Furnace of the type as used in one of Largest Smelteries.

Mining and Smelting Machinery that Improves the Process

Machinery for
Mining and Smelting
Rock Crushing
Cement Making
Power Transmitting
Wood Impregnating

Gas Generating
Gas Producers

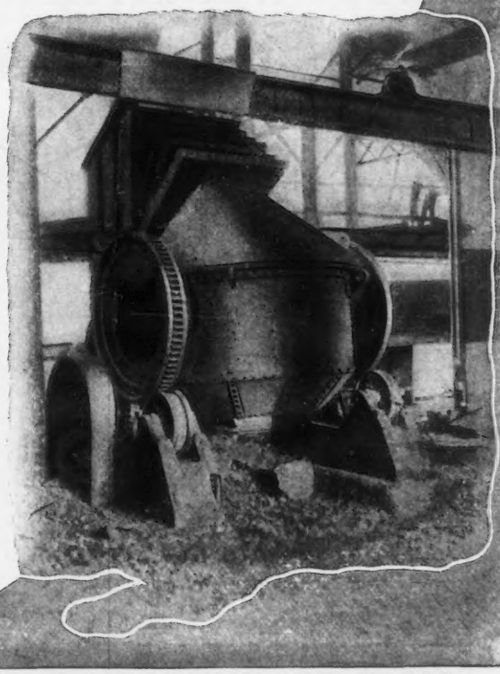
By means of our large force of engineers working in conjunction with our branch offices in all parts of the world, we are enabled to keep in close touch with the requirements of the mining industry, meeting them all and anticipating many.

We are prepared to substantiate our claim of being the leading builders of machinery for the Mining and Metallurgical industries. Our standard machines or such modifications as are necessary to meet special conditions will yield for you the largest possible production at the smallest expense.

Illustrated Bulletins describe our large and complete line. Free on request.

Export Shipments

We pay particular attention to export shipments in order to insure their arrival at destination intact. Machinery as bright as when it leaves the factory. Weight of packs limited for mule-back transportation if required.



Great Falls Type Converter

at the smeltery of the Cananea Consolidated Copper Co. This machine represents the greatest advance in the process of bessemerizing copper matte.

Write for Bulletin 16-16.

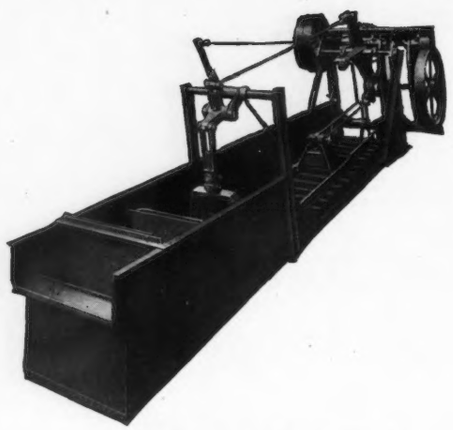
WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway, New York — Power & Mining Machinery Works: Cudahy, Wisconsin

District Offices—Chicago, El Paso, San Francisco, London

M387.8

One Plant Bought 71



Dorr Classifier Simplex. (Model C) Patented

They first bought one as an experimental machine. Six months later they bought eighteen more. Today they have seventy-one.

This is only one of many similar instances where the **Dorr Classifier** has been permanently adopted after being subjected to the most rigid test.

The advantages of the **Dorr Classifier** have been recognized for years by both large and small users. The flexibility of the machine, together with the small amount of attention required, low cost of operation and maintenance, appeal to all operators.

Perhaps you are not getting the separation you desire, or it may be you are contemplating a certain separation. In either case, we may be able to be of assistance to you. We are daily coming in contact with classifying problems which may be identical with yours.

There's a standard type of Dorr Classifier to meet your requirements. Our Catalog No. 5 will help you decide. We'll be glad to send it.

The Dorr Company

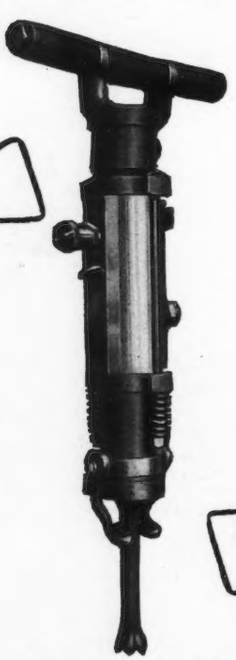
Engineers

New York
17 Battery Place

Denver
1009 17th Street

London, E. C.
16 South Street

No. 66 "Wondersinker" Means Low-Cost Drilling



Why Low Cost

In the first place the No. 66 is as low in price as inferior drills of the same size. Next, it will produce more feet of holes in a given time than any drill of corresponding size having the same air inlet. Third, it uses less air in doing more work. Fourth, it gives uninterrupted service, day in and day out, regardless of conditions, because of its ruggedness and simplicity. The saving of power combined with the increased footage will more than offset the cost of the No. 66 in a few months.

"Wondersinker" Features

Hardsocg features tell the story of "Wondersinker" economy. It is self-rotating, has a full rubber handle, exhaust control, automatic oiler, shock absorber, and the best and most satisfactory bit retainer ever attached to a drill. It works on a protected spiral compression spring—the kind that never breaks. There are very few parts—nothing to get out of order—and the whole machine weighs only 40 lbs.

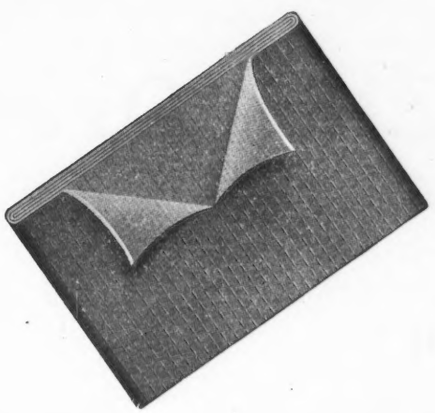
It takes a special bulletin to describe this wonderful drill in detail. We have a copy ready to mail to you. Where shall we send it?

Hardsocg Wonder Drill Co., Ottumwa, Iowa

REXALL

DOUBLE-STITCHED BELTING

¶ Regardless of the conditions surrounding your elevating or conveying problem, we have a belt to meet your requirements. Send for samples.



Its Stable Construction Means Long Life

The construction of "Rexall" Belting insures against ply separation, pulling out of fasteners, or tearing out of bucket bolts. This is due to the use of the most tightly woven duck of enormous tensile strength reinforced by inter-stitching, resulting in the utmost stability of fabrication.

"Rexall" on your conveyor or elevator means a big saving of money and trouble and increased length of service. Write or wire for samples.

IMPERIAL BELTING COMPANY

Lincoln and Kinzie Streets
CHICAGO

42 Broadway, New York, N. Y.
325 Walker Bank Bldg., Salt Lake City, Utah
423 Yeon Bldg., Portland, Ore.

Single Friction Drum Electric Hoist

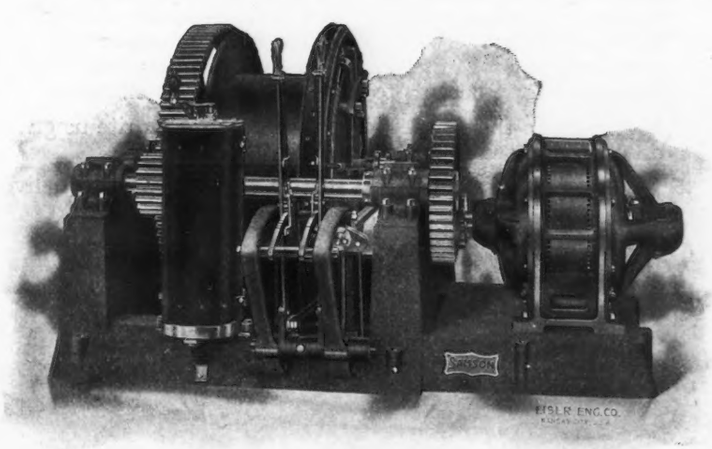
THE Hoist illustrated is not the smallest nor the largest Electric Hoist of this type we build, Single Drum and Double Drum.

These Hoists have side frames high enough to permit gears clearing the floor; the frames are sectional. The sub-base for motor is machined and carefully fitted to main frame of hoist.

Gears are steel, accurately cut from solid metal on automatic machines; motor pinions are rawhide. Gear guards made of heavy steel hands are furnished. The clutch and brake bands are lined with thermoid, a composition which has a smooth and steady release and will outwear any wood brake liner made.

These Hoists are designed and built for the most severe service.

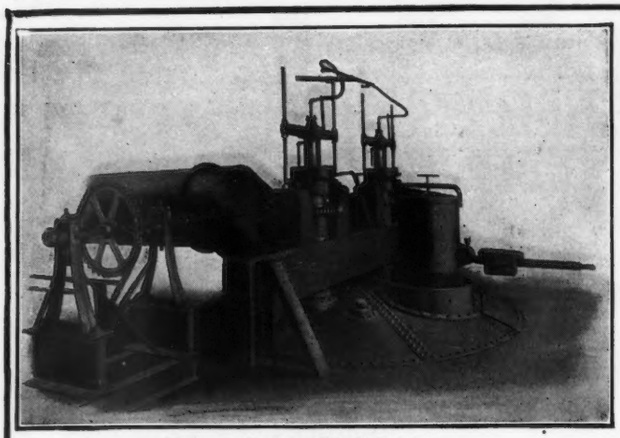
The Motors are Alternating Current or Direct Current as may be required.



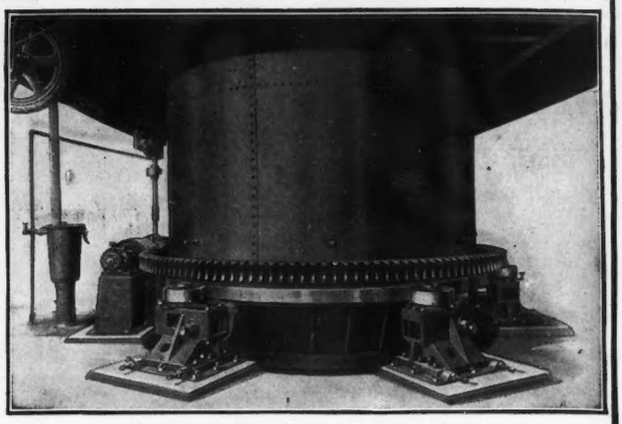
5,000 pounds Rope Pull, 300 feet per minute, 52 H.P. Induction Motor.

Our new Hoist Catalog mailed upon request.

The English Iron Works Company, Kansas City, Mo., U. S. A.



Stationary Section, with stirring gear.



Revolving Section, showing worm gear drive.

For Smelting Zinc Ores

Higher economy and more uniform results can be secured if your furnaces are producer gas fired.

WOOD Mechanically Operated Gas Producers

are ideally adapted for service in the modern smelter plant. They operate with minimum steam and water. No hand poking is required even when maximum gas production occurs. No clinker formation. Uniform quality of gas assured with CO content between 26 and 28%.

Let us send you full particulars. Write today.

R. D. Wood & Company - Philadelphia, Penna.

Makers of Hydraulic Machinery, Gas Holders, Centrifugal Pumps, Cast Iron Pipe, Fittings, Valves and Special Castings.

OTTUMWA High Efficiency Electric Hoists

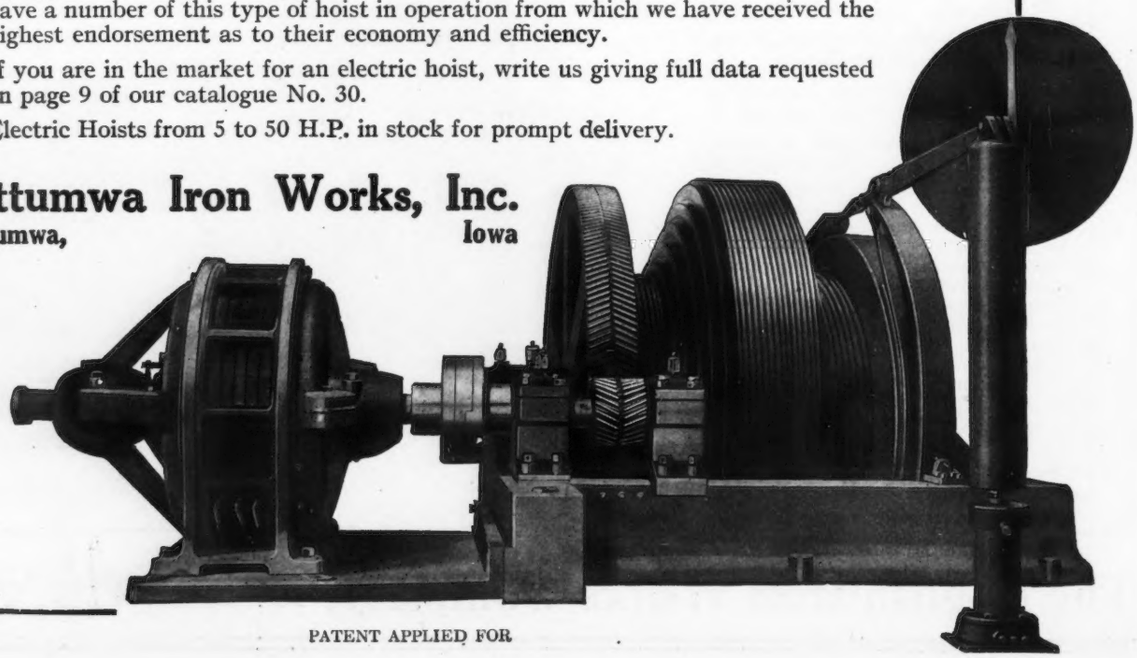
You can reduce your power cost by this design of Electric Hoist. It also reduces first cost by making possible a smaller motor, consequently reducing the maximum demand charge. The brake is operated by oil under pressure, and is equipped with overwinding device, and automatic emergency application. We have a number of this type of hoist in operation from which we have received the highest endorsement as to their economy and efficiency.

If you are in the market for an electric hoist, write us giving full data requested on page 9 of our catalogue No. 30.

Electric Hoists from 5 to 50 H.P. in stock for prompt delivery.

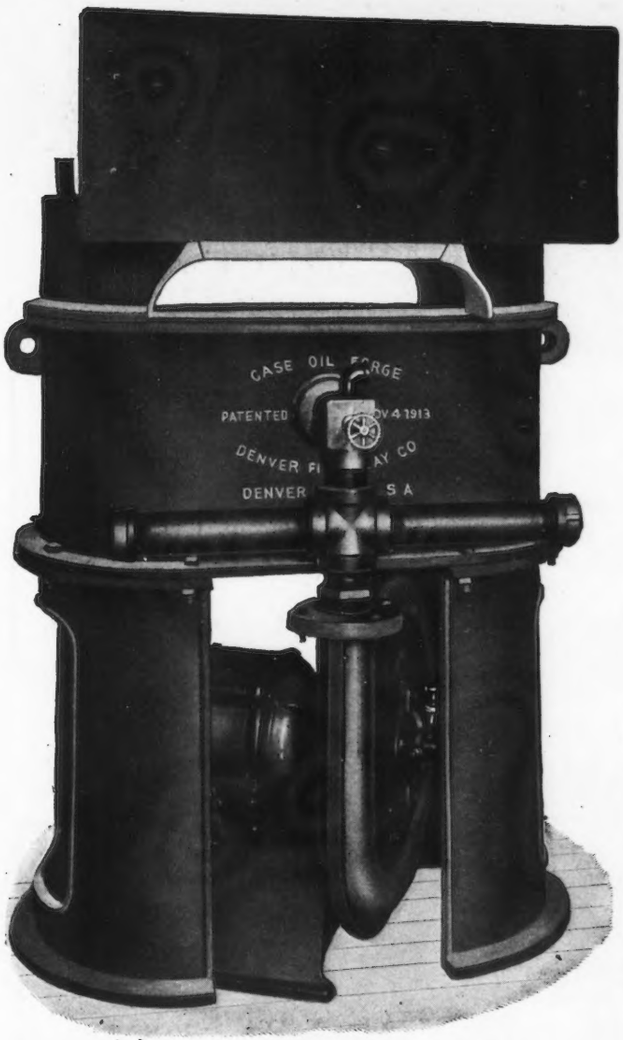
Ottumwa Iron Works, Inc.

Ottumwa, Iowa



PATENT APPLIED FOR

No Smoke, No Gases Less Noise



Oil-Fired Drill Steel Forge

Oil fuel takes all the trouble and loss out of drill treating.

Enables you to quickly start up and heat the drill without sulphurization, and the steel won't burn because it's in plain sight every minute.

With this furnace the whole time goes to the work. Saves 10% steel and 20 to 40% fuel.

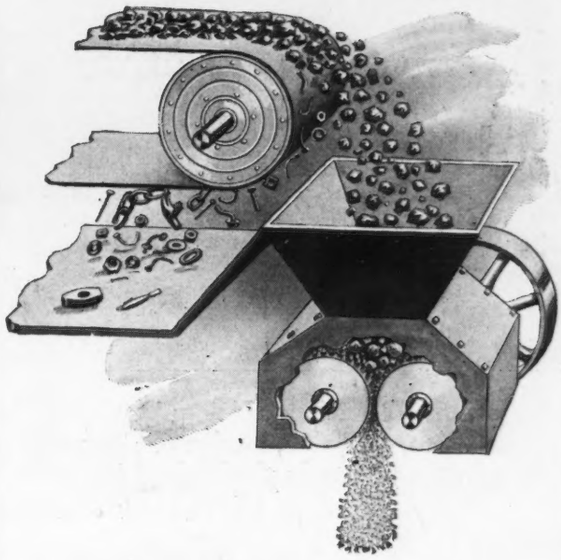
Write today and let us tell you the "hows and whys."

Denver Fire Clay Company
Denver, Colo., U. S. A.

DENVER FIRE CLAY CO. PRODUCT

HAVE SURVIVAL VALUE

Save Those Repair Bills On Your Crusher



DINGS
Magnetic Pulleys

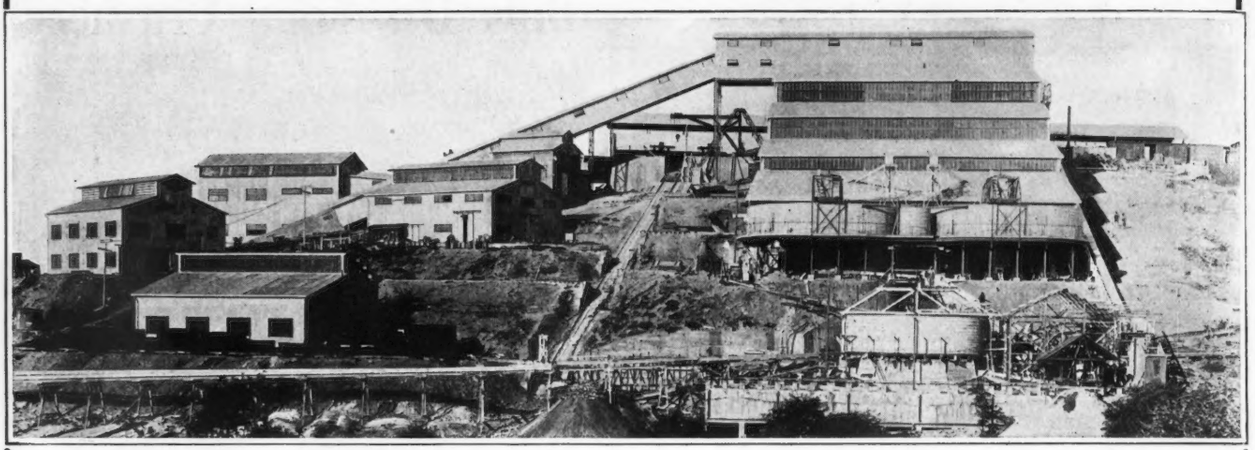
mean complete relief from crusher troubles due to tramp metals. They quickly pay for themselves in the saving of costly repairs and delays. Easy to install. 100% efficient. Operate as head pulley of belt conveyor. Made in all diameters and every width. Put your crusher problem up to our engineers in detail. No obligation. Full particulars and prices on request. **Write.**

Dings Magnetic Separators

for smelters and refiners, zinc, lead and tin mines, etc., are built in standard and special designs to meet every requirement. Send samples of your ore for preliminary tests. Our laboratory and engineering department are at your service for the solution of your problem.

Dings Magnetic Separator Co.
673 Smith St. - Milwaukee, Wis.

Butchart Concentrating Tables

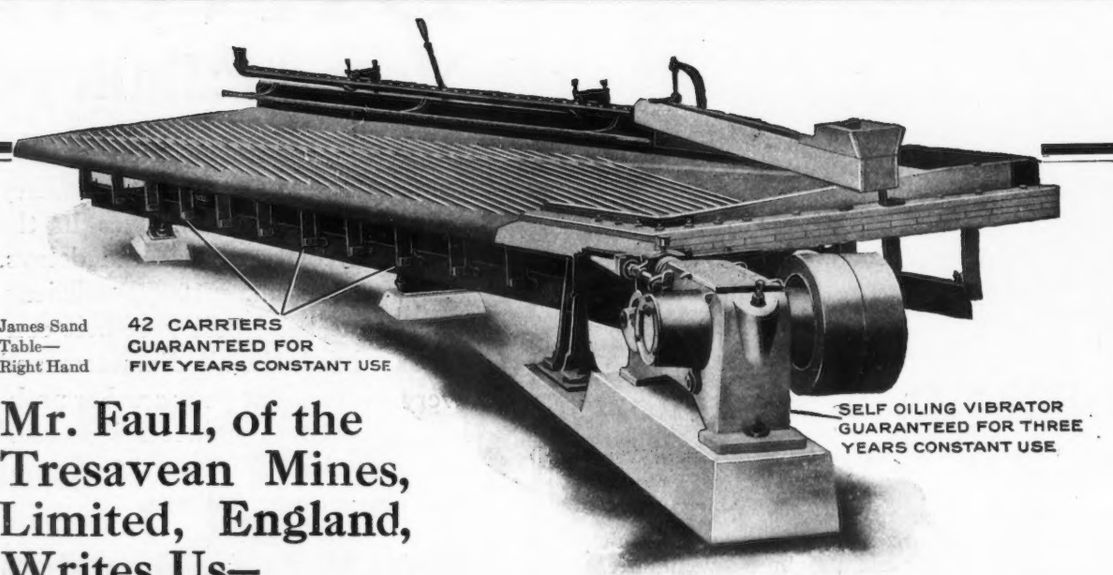


are the exclusive table equipment of the Burro Mountain Copper Co., Tyrone, New Mexico, a Phelps, Dodge & Co. property. This is one of the most modern and up-to-date plants in the United States.

Why not adopt BUTCHART TABLES for YOUR new mill?

Write for Bulletin No. 2. Submit your concentration problems.

W. A. Butchart, 605-607 Mercantile Bldg., Denver, Colo.


James Sand Table— Right Hand
42 CARRIERS GUARANTEED FOR FIVE YEARS CONSTANT USE
SELF OILING VIBRATOR GUARANTEED FOR THREE YEARS CONSTANT USE

Mr. Faull, of the Tresavean Mines, Limited, England, Writes Us—

"No expense in renewals has so far been incurred in connection with the James Tables. The metallurgical efficiency is excellent. We are well pleased with these tables."

Such reports come to us from all parts of the world, telling about the high mechanical and metallurgical efficiency of James Concentrating Tables. Over 100 James Tables are used treating tin ore in the Cornwall Mines of England. Over 100 installed in the past 12 months in the zinc and lead mines of Missouri. Over 1,500 are in use in America.

We manufacture Jigs, Screens, Classifiers, Ore Feeders, Sand and Slime Tables, large capacity, Roughing Tables and Special Tables designed for any purpose.

Write for Descriptive Circulars and prices.

THE JAMES ORE CONCENTRATOR COMPANY
35 Runyon Street - - - - - - - - - Newark, N. J., U. S. A.

and HOLMAN BROTHERS, LIMITED
Camborne - - - - - - - - - - Cornwall, England

Meets Every Condition for a Perfect Roast

The high temperature so necessary for proper roasting can be attained and maintained most successfully with

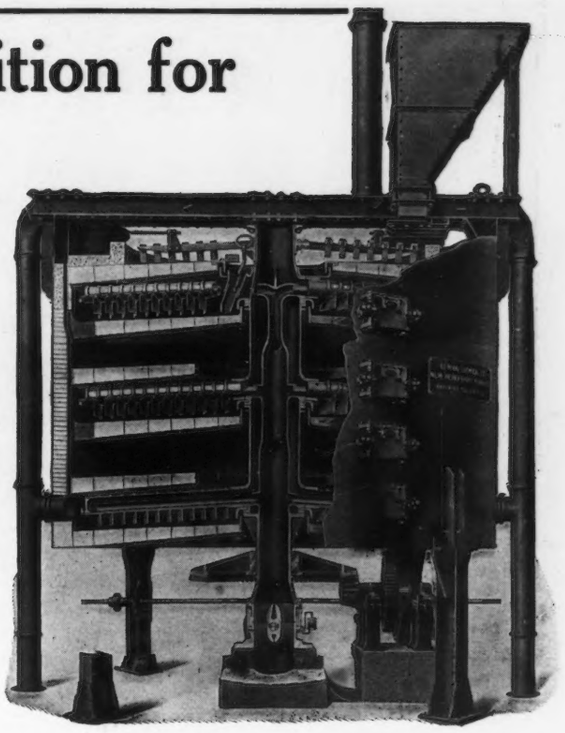
The New Herreshoff Temperature Controlled and Air-Cooled Furnace

PATENTED

If you are desirous of securing better results—more profitable results—from your roasts, start now to investigate the New Herreshoff Furnace.

Over 2,000 of them are in use roasting ores for chemical, metallurgical and industrial purposes, and giving the most satisfactory results.

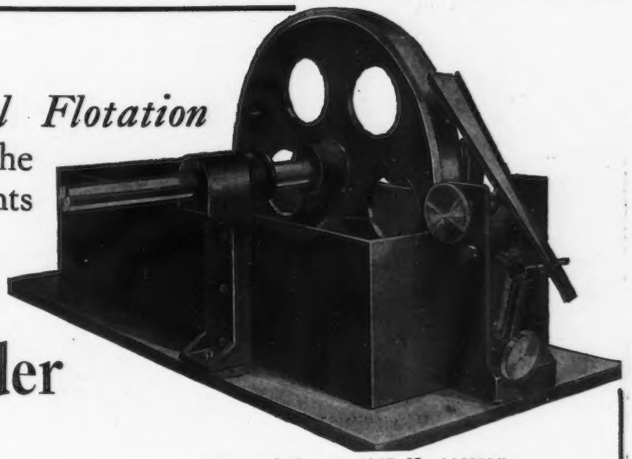
Write for the Herreshoff Bulletin and get complete information.



GENERAL CHEMICAL COMPANY
Herreshoff Furnace Department
25 Broad Street - - - - New York, N. Y.

PACIFIC FOUNDRY COMPANY
18th and Harrison Streets San Francisco California
Pacific Coast Agents

The Problem of *Successful Flotation* depends to a great extent upon the regularity of the flow of reagents



The Braun K. & K. Mechanical Disc Feeder
For Oils and Acids

(Patented Nov. 30, 1915, No. 1162291)

absolutely eliminates detrimental results due to irregularity in feeding reagents.

A Mechanical Disc is mounted on a shaft and revolved within an iron tank. A thin film of oil adheres to the finished surface of the disc as it revolves through the oil, which film is constant, being regulated by an adjustable metallic scraper. A portion of this film is transferred to the trough through which it flows into the flotation machine.

The feed is regulated by adjusting the position of the trough by means of micrometer screws.

Grit, sludge, or any foreign matter cannot choke it.

TWO TYPES of machines are offered—one for Oil and one for Acid.

The Acid Feeder is constructed of lead and bronze to withstand the action of the reagents.

Fitted with tight and loose pulleys (not shown in illustration).

Measurements: Length, 30 in.; width, 20 in.; height, 15 in.

BRAUN K. & K. OIL FEEDER, $40.00.

BRAUN K. & K. ACID FEEDER, $75.00.

Ask for Bulletin A106

BRAUN-KNECHT-HEIMANN-CO.
San Francisco, U. S. A.

THE BRAUN CORPORATION
Los Angeles, U. S. A.

Manufacturers of Laboratory Labor-Saving Machinery
Specialists in Laboratory Equipment and Testing Apparatus
Dealers in Laboratory Glassware and Chemicals

BARSTEEL

Baldwin-Westinghouse Electric Locomotives

STRENGTH
ACCESSIBILITY } **are built in**
QUALITY

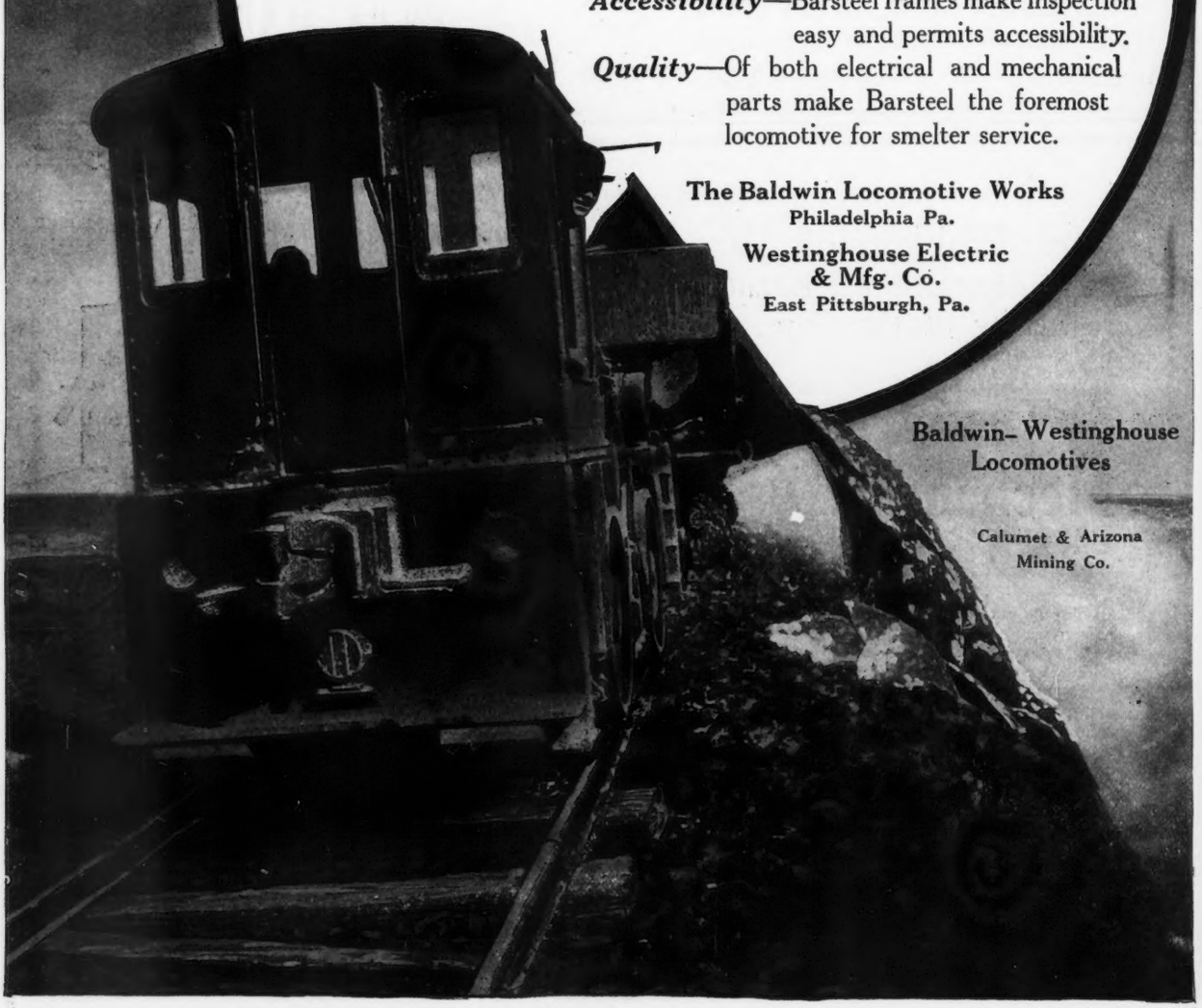
Strength—Barsteel frames are stronger than solid frames.

Accessibility—Barsteel frames make inspection easy and permits accessibility.

Quality—Of both electrical and mechanical parts make Barsteel the foremost locomotive for smelter service.

The Baldwin Locomotive Works
Philadelphia Pa.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.



Baldwin-Westinghouse Locomotives

Calumet & Arizona Mining Co.